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NUCLEAR SCIENCE ABSTRACTS

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Technical Information Service Extension, Oak Ridge, Tennessee

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NUCLEAR SCIENCE ABSTRACTS

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

CONTENTS

Volume 12, Number 2 Suppl., January 31, 1958

Category	Abstract	Page
BIOLOGY AND MEDICINE	1816	203
Radiation Hazards and Protection	1817	203
CHEMISTRY	1818	203
Analytical Procedures	1843	206
Fluorine and Fluorine Compounds	1850	208
Laboratories and Equipment	1853	208
Radiation Chemistry	1854	208
Radiation Effects	1855	208
Rare Earths and Rare-earth Compounds	1858	209
Separation Procedures	1860	209
Transuranic Elements and Compounds	1907	214
Uranium and Uranium Compounds	1908	214
Waste Disposal	1923	216
ENGINEERING	1924	216
Heat Transfer and Fluid Flow	1930	217
Materials Testing	1940	218
Waste Disposal	1950	218
MINERALOGY, METALLURGY, AND CERAMICS	1951	218
Ceramics and Refractories	1951	218
Corrosion	1953	219
Metals and Metallurgy	1967	220
PHYSICS	2017	226
Crystallography and Crystal Structure	2025	228
Electrical Discharge	2026	228
Gases	2028	228
Isotopes	2029	229
Isotope Separation	2032	229
Mathematics	2037	230
Measuring Instruments and Techniques	2039	230
Meteorology	2041	230
Neutrons	2042	230
Nuclear Physics	2045	231
Nuclear Properties	2049	231
Nuclear Reactors	2052	232
Particle Accelerators	2177	249
Radiation Absorption and Scattering	2180	249
Radiation Effects	2181	249
Shielding	2187	250
Spectroscopy	2189	250
Uranium and Uranium Compounds	2190	250
PERSONAL AUTHOR INDEX		INDEX-1
NUMERICAL INDEX OF REPORTS		INDEX-4

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 2 January 31, 1958

SUPPLEMENT

BIOLOGY AND MEDICINE

1816 UCLA-260

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1953. July 1, 1953. Decl. Mar. 6, 1957. 99p. Contract AT-04-1-GEN-12. $15.30(ph OTS); $5.40(mf OTS).

Radiation Hazards and Protection

1817 A-7.390.29

[Tennessee Eastman Corp., Oak Ridge, Tenn.] SHG CALCULATIONS FOR ALPHA PARTICLE MAC FOR URANIUM BEARING AIR BORNE DUST IN Y-12. Notes on Health Physics Theory. John W. Morfitt. Apr. 4, 1947. Decl. Mar. 28, 1957. 13p. $3.30(ph OTS); $2.40 (mf OTS).

Calculations of the maximum allowable concentration of uranium α particles in airborne dust are presented. Several problems involving α exposure are included. (auth)

CHEMISTRY

1818 ANL-4000(Del.)

Argonne National Lab., Lemont, Ill. CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT FOR JULY, AUGUST AND SEPTEMBER 1946. June 2, 1947. Decl. with deletions Feb. 12, 1957. 127p. Contract W-31-109-Eng-38. $19.80(ph OTS); $6.30(mf OTS).

Power Pile Problems. The resistance to thermal stresses of BeO bricks annealed at temperature greater than 1300°C was far greater than unannealed BeO bricks. Calculations are given for BeO fuel tube resistance to thermal stresses. Preliminary studies were made to determine possible correlation between the elastic modulus and the density of BeO shapes. Measurements of the linear dimensions of hot-pressed $BeO-UO_2$ pellets and cylinders before and after irradiation show an increase in length. The steady state activity due to 5d and 9h Xe in the coolant of the operating high temperature pile was calculated for shaped fuel rods. Diffusion of fission products from UO_2–BeO fuel materials is described. Impregnation of graphite with U compounds for use as fuel rods is described. Graphite Problems. An investigation of the properties of irradiated graphite is being carried out. Measurements of stored energy from the heat of dispersal in K were carried out. The apparatus for measuring the stored energy is given. A summary of an investigation to determine the heat of sublimation and vapor pressure for graphite is presented. Radiochemistry. The best values for the half lives of La^{140}, Ba^{140}, Mo^{99}, and Pr^{143} are given. Aluminum absorption curves for 12.8d Be^{140} from Pu and U fission are given. Geiger-Mueller tube development, sensitivity distribution in end window tubes, and construction of a magnetic lens β-ray spectrometer is included. Special Problems. Data are given on the magnetic moment of Pu, effect of neutron irradiation on the thermocouple power of the Chromel-Alumel junction, effects of γ radiation on insulating materials, and remote control development. (W.L.H.)

1819 ANL-4006(Del.)

Argonne National Lab., Lemont, Ill. CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT FOR JANUARY, FEBRUARY, AND MARCH 1947. Oct. 3, 1947. Decl. with deletions Feb. 12, 1957. 123p. Contract W-31-109-Eng-38. $19.80(ph OTS); $6.30(mf OTS).

1820 ANL-4185(Del.)

Argonne National Lab., Lemont, Ill. CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT FOR JULY THROUGH DECEMBER 1947. Oct. 1, 1948. Decl. with deletions Feb. 12, 1956. 145p. Contract W-31-109-eng-38. $22.80(ph OTS); $7.20(mf OTS).

Power Pile Problems. Investigations are reported on: the properties of BeO, impregnation of graphite with U, effect of heating and radiation on U-impregnated graphite, diffusion of radioxenon from $BeO-UO_2$, and radiation effects on BeO and $BeO-UO_2$ materials. Solid State Problems. The studies reported on are: radiation effects on artificial graphite and natural graphite crystals, neutron capture cross section of C^{13}, distribution of C^{14} in irradiated graphite, heat of sublimation and vapor pressure of graphite, radiation effects on gas production in crystals, sputtering of metals on irradiation, absorption spectra of irradiated and unirradiated MgO crystals, alkali halide crystals with color centers, and Tl activated alkali halide phosphors. Radiochemistry. Slow neutron fission yields in U^{233} and preparation of fission product Sn isotopes were studied. Analytical Problems in spectrography of Np^{237}, $U^{238}-U^{235}$, graphite and BeO were investigated. (T.R.H.)

1821 ANL-4286(Del.)

Argonne National Lab., Lemont, Ill. CHEMISTRY DIVISION, SECTION C-I SUMMARY REPORT FOR JANUARY, FEBRUARY, AND MARCH 1949. May 12, 1949. Decl. with deletions Feb. 12, 1957. 45p. Contract W-31-109-eng-38. $7.80(ph OTS); $3.30(mf OTS).

Physical and Inorganic Chemistry. Studies are reported on: volatile complexes of $ZrCl_4$ and $HfCl_4$ with $POCl_3$; reaction of UCl_4 with $LiAlH_4$; preparation and properties of metal uranates and polyuranates; heats of solution of $UO_2(NO_3)_2$ hydrates; absorption spectra of Np in $HClO_4$; and separation of Np and Pu chlorides by a flow method. Process Chemistry. Extraction of Th from Mallinckrodt U raffinate was studied. Nuclear Chemistry and Radiochemistry. Investigations were carried out on: organic tritium; exchange reactions of U ions in solution; exchange reactions of Fe in aqueous solutions; Tc recovery from old

Hanford slugs; (n,2n) cross section of Pa^{231}; and spontaneous fission counting U^{236} and Pu^{238}. (T.R.H.)

1822 ANL-4490(Del.)
Argonne National Lab., Lemont, Ill.
CHEMISTRY DIVISION, SECTION C-I SUMMARY REPORT FOR APRIL, MAY, AND JUNE 1950. D. W. Osborne, ed. July 27, 1950. Decl. with deletions Feb. 12, 1957. 79p. Contract W-31-109-eng-38. $12.30(ph OTS); $4.50(mf OTS).

Nuclear Chemistry and Radiochemistry. Measurements of the half-lives of Ac^{227} and RaD(Pb^{210}) were continued. The effective pile neutron capture cross sections for U^{236} were determined by measuring the activity of the resultant U^{237} with an end window geiger counter. A study of ion chambers for tritium analysis is presented. Procedures were developed for the determination of tritium and C^{14} in organic compounds. Physical and Inorganic Chemistry. An investigation of the electrochemistry of Np in perchloric acid solution was undertaken. The investigation of the controlled potential electrolysis methods for the preparation of the various rhenium oxidation states was continued. Preliminary measurements of the heats of solution of the $UO_2(NO_3)_2$ hexa-, tri-, and dihydrates in water and a series of organic solvent were repeated. Data are given on the extraction of Am, Cm, and Pu in aqueous HCl-butyl phosphate ester systems. Electro-Chromatographic separation of Ag and Ni in 4N NH_3 is described. The electrical conductivity of BrF_5 and solutions of HF in BrF_5 is presented. The separation of Pa and Th by chloride distillation is described. Process Chemistry. Progress is reported on the following: extraction of ionium and Pa^{231} from Mallinckrodt raffinate; further purification of Pa from Pa^{230} waste stream 2U1; recovery of Sc and Pa^{230} from Pa^{230} wastes; separation of Sc from Th and rare earths using a TBP–HCl system; separation of Th, Pa, and U using a TBP–HCl–HF system; separation of Pa and U from neutron irradiated Pa^{230}; and removal of fission products from neutron-irradiated Pa^{230}. (W.L.H.)

1823 ANL-4613(Del.)
Argonne National Lab., Lemont, Ill.
CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT FOR JANUARY, FEBRUARY, AND MARCH, 1951. J. R. Gilbreath and O. C. Simpson, comps. Oct. 3, 1951. Decl. with deletions Feb. 11, 1957. 75p. Contract W-31-109-Eng-38. $12.30(ph OTS); $4.50(mf OTS).

Progress is reported in studies on the physical properties of graphite; the effects of irradiation on ice; an investigation of color centers in single KI crystals; thermal self-diffusion in Ag; the optical properties of irradiated diamonds; the preparation of a cyclotron target assembly to permit irradiation of Ag foils at controlled temperatures; the oxidation of formic acid by exposure to Co^{60} γ rays and tritium β particles; the effect of Co^{60} γ rays and tritium β particles on dissociation and recombination reactions in formic acid solutions; the γ ray induced reaction of deuterium gas with liquid water; the production of hydrogen deuteride by γ irradiation of aqueous solutions containing dissolved deuterium and hydrogen; applications of O^{18} to a study of the radiation induced water-oxygen reaction; determinations of the decay schemes of Zr^{95} and Th^{231}; studies on the spectrum of actinium; the spectrographic determination of rare earths in Th and Th compounds; and a series of measurements on the nuclear magnetic moment of Rb^{85}, Rb^{87}, and I^{127}. (C.H.)

1824 ANL-4943(Rev.)
Argonne National Lab., Lemont, Ill.
CHEMISTRY DIVISION, SECTION C-I QUARTERLY REPORT [FOR] JULY, AUGUST, AND SEPTEMBER 1952. D. W. Osborne, ed. Nov. 1, 1952. Decl. Feb. 7, 1957. 31p. Contract W-31-109-eng-38. $6.30(ph OTS); $3.00 (mf OTS).

Progress report is presented covering the following studies: thermal-neutron fission cross sections of U^{239} and Th^{233}; cross sections for U^{233} (n,2n); neutron absorption cross sections of Pu^{240} and Pu^{241}; Np recovery; U–O system in the composition range $UO_{2.50}$ to $UO_{2.67}$; Np(V) oxalate complexes in aqueous solution; interpretation of the visible and near-infrared spectra NpO_2^+ and PuO_2^{++} ions; Pa(IV) in solution; investigation of the Th nitrate hydrate system; H isotope effect in the hydrolysis of triphenylsilane; and the nuclear alignment and entropy of liquid He^3. (J.E.D.)

1825 BMI-1057(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING NOVEMBER 1955. Russell W. Dayton and Clyde R. Tipton, Jr. Dec. 1, 1955. Decl. with deletions Mar. 12, 1957. 70p. Contract W-7405-eng-92. $10.80(ph OTS); $3.90(mf OTS).

Studies are reported on: thermal conductivity of U–Cr, U–Si, and U–Ti alloys; creep properties of Zircaloy-2; bursting pressures of Zircaloy-2 extruded tube and cold-formed and welded Zr tube at high temperatures; corrosion of types 304LC, 347, and 329 stainless steel by uranium fluoride–nitric acid liquors; effects of molten fluoride slags at 1650°C on commercial refractories; effect of calcining conditions on bulk density of sintered BeO compacts; sinterability of BeO made from different beryllium hydroxides; physical properties of UO_2 compacts; phase studies of U–Mo alloys; quenching of U–Zr alloys; corrosion of U–Zr alloy by 680°F degassed water; corrosion of Zircaloy-3 in 680°F water and 750°F steam; hardness of U–Ti alloys vs. cooling rate; hot hardness of as-rolled U–Ti; oxidation of Nb, Nb–Mo, and Nb–Cr at 600 to 1200°C; reaction rate of U–Zr and U–Cr with H_2; and H_2 content of hydrided Zr alloys at high temperatures. (T.R.H.)

1826 C-2.350.6
Tennessee Eastman Corp., Oak Ridge, Tenn.
PILOT PLANT CHLORINATION WITH HEXACHLOROPROPYLENE. Progress Report. H. A. Gottschall, J. F. Manneschmidt, J. M. Schmitt, E. L. Wagner, and A. J. Miller. Jan. 29, 1946. Decl. Feb. 19, 1957. 15p. Contract W-7401-eng-23. $3.30(ph OTS); $2.40(mf OTS).

Interim stages of development are described for both the atmospheric and pressurized pilot plants for chlorination of UO_3 to UCl_4 by hexachloropropylene. (auth)

1827 CF-56-10-48
Houdry Process Corp. Research and Development Labs., Linwood, Penna.
PREPARATION OF THORIUM OXIDE SOLS. Third Quarterly Report, 1956. J. J. Donovan and H. Shimizu. Oct. 9, 1956. 12p. [For Oak Ridge National Lab.] Contract W-7405-eng-26, Subcontract 904. $3.30(ph OTS); $2.40(mf OTS).

Ultra-filtration of 0.25M pH 4 thorium nitrate sols through cellophane membranes (50 A pore diameter) has given product sols of 7.5:1 weight ratio thoria to nitrate in a single pass, with 80% recovery of the thoria. These sols contain thoria micels with an average diameter of 140 A indicated by x-ray small angle scattering, and 25 A crystallite diameter from x-ray-diffraction line broadening. A small quantity of beads of thorium phosphate gel have been prepared to be available for evaluation as ion exchange material and for hydrothermal stability tests. Preliminary work has been completed on the preparation of thorium oxide gels. It was found that both hexamethylene-

tetramine and ammonium acetate buffers can be used to coagulate thoria sols into good gels. Work is continuing on this system with the object of preparing thoria beads or microspheres suitable for use in reactor blanket systems. Design work on the Ultrasonic Interface Follower is proceeding satisfactorily at Sperry Products, Inc. The development of electrophoretic techniques for studying thoria sols and slurries is continuing. Experiments with a simple cell have shown that pure thoria slurries contain positively charged particles. (auth)

1828 ESP-52-47

Du Pont de Nemours (E. I.) & Co. Experimental Station, Wilmington, Del.

CATALYTIC COMBINATION OF HYDROGEN WITH OXYGEN. Progress Report [for] Period September 10, 1951–February 15, 1952. H. R. Arnold. Mar. 26, 1952. Decl. Mar. 16, 1957. 21p. $4.80(ph OTS); $2.70(mf OTS).

Alumina, charcoal, and silica gel supported Pd and Pt catalysts were shown to be effective for the catalytic combination of low concentrations of H_2 and O_2 in He, in 98 to 100% conversion per pass at atmospheric pressure and 8000 space velocity. (W.L.H.)

1829 LA-1659

Los Alamos Scientific Lab., N. Mex.

PREDICTED STRUCTURE AND DENSITY OF BERYLLIUM HYDRIDE. J. F. Lemons, W. B. Lewis, R. D. Fowler, Eugene Staritzky, and C. E. Holley, Jr. Dec. 1, 1953. Decl. Apr. 1, 1957. 30p. Contract W-7405-eng-36. $0.35 (OTS).

Various properties of BeH_2 are predicted, based on the properties of neighboring hydrides. Included are predictions of the stability of the Be-H bond, the stability of an ionic lattice for BeH_2, polymeric structure, and density. (W.L.H.)

1830 MLM-828(Del. 2)

Mound Lab., Miamisburg, Ohio.

TECHNICAL ACTIVITIES QUARTERLY REPORT THROUGH MARCH 17, 1953. Mar. 31, 1953. Decl. with deletions Mar. 18, 1957. 41p. Contract AT-33-1-GEN-53. $6.30(ph OTS); $3.00(mf OTS).

1831 MLM-929(Del. 1)

Mound Lab., Miamisburg, Ohio.

TECHNICAL ACTIVITIES QUARTERLY REPORT THROUGH DECEMBER 17, 1953. Dec. 31, 1953. Decl. Mar. 18, 1957. 27p. Contract AT-33-1-GEN-53. $0.30 (OTS)

1832 ISC-137

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT FOR JANUARY, FEBRUARY, AND MARCH 1951. W. E. Dreeszen. May 1, 1951. Decl. Mar. 27, 1957. 60p. Contract W-7405-eng-82. $9.30(ph OTS); $3.60(mf OTS).

1833 ISC-184

Ames Lab., Ames, Iowa.

SEMI-ANNUAL PROGRESS REPORT IN CHEMISTRY FOR THE PERIOD APRIL 1, 1951—SEPTEMBER 30, 1951. F. H. Spedding, C. A. Goetz, C. V. Banks, F. R. Duke, V. A. Fassel, I. E. Fulmer, M. Griffel, R. S. Hansen, D. S. Martin, Jr., R. E. Rundle, H. Shull, H. J. Svec, and A. F. Volgt. Dec. 3, 1951. Decl. Mar. 28, 1957. 45p. Contract W-7405-eng-82. $7.80(ph OTS); $3.30(mf OTS).

A detailed progress report is made covering the chemistry of rare earths, slurry studies, activity coefficients of binary solutions, reaction kinetics, low-temperature calorimetry reaction between Ca metal and water, radiochemistry, study of radioactivity, analytical research on Be, Ca, Th, Ce, Zr, and rare earths. (J.E.D.)

1834 NYO-1234

Hooker Electrochemical Co., Niagara Falls, N. Y.

PREPARATION OF BORIC ACID FROM DIMETHYL ETHER–BORON TRIFLUORIDE COMPLEX. Anthony Loverde. Apr. 28, 1954. Decl. Mar. 12, 1957. 14p. Contract AT(30-1)-1524. $3.30(ph OTS); $2.40(mf OTS).

The preparation of B^{10} metal involves a preliminary isotopic separation of B^{10} from B^{11} through the $(CH_3)_2O-BF_3$ complex. Conversion of the complex to H_3BO_3 constitutes a step in a proposed electrolytic process for making the desired boron metal. Hydrolysis of the complex to form H_3BO_3 occurs readily in a boiling aqueous slurry of the stoictriometric quantity of $CaCO_3$. Recovery of anhydrous H_3BO_3 required a filtration to remove CaF and evaporation to remove water. The return of the evaporated water to the process eliminates volatility losses of acid. Yields of H_3BO_3 are practically 100% by this method. (auth)

1835 NYO-1239

Hooker Electrochemical Co., Niagara Falls, N. Y.

A STUDY OF THE DECOMPOSITION RATE OF POLYMER DURING FRACTIONATION UNDER DIMINISHED PRESSURE. J. L. Hanner. June 1, 1954. Decl. Mar. 12, 1957. 18p. Contract AT(30-1)-1524. $3.30(ph OTS); $2.40(mf OTS).

A study of the decomposition rate of polymer, $(CH_3)_2O \cdot BF_3$, refluxing through a 1 in. × 48 in. laboratory column packed with ⅛ in. glass helices under diminished pressures was made. It was found that decomposition increased with temperature. At a temperature level approximately equivalent to that expected in plant operation it was found that the decomposition rate amounted to about 2% a day. The same rate was obtained on a pilot plant scale using the 6 in. × 16 in. monel column packed with 0.24 in. × 0.24 in. monel protruded packing. Variations in decomposition rates obtained in a total of about 50 runs were indicated to be due to varying polymer quality. (auth)

1836 ORNL-1036(Del.)

Oak Ridge National Lab., Tenn.

CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1950. Sept. 10, 1951. Decl. with deletions Mar. 1, 1957. 74p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

Decomposition-precipitation temperatures and acidities of $UO_2SO_4-UO_3-H_2O$ solutions are presented graphically, and the relation of these data to the homogeneous reactor experiment is discussed briefly. The x-ray-diffraction spectrometer tracing of powdered uranyl orthosilicate trihydrate is shown, and the principal lines are tabulated. Further studies on the aqueous complexes of Zr^{+4} and Cl^- at ionic strength 3.00, $HClO_4$ acidity <1M, and Zr^{+4} concentration $<10^{-5}$M are reported. Ultracentrifuge and freezing-point-lowering data indicating dimerization UO_2F_2 in aqueous solution are reported. Some of the variables in the removal of Ce from Np and rare earths by precipitation of $Ce(IO_3)_4$ are discussed. During a tracer study of the reaction of formaldehyde with aldehydes containing one α H, the compounds β-hydroxyl-α-phenyl-(acrylo-β-C^{14}) phenone and 1,1,2,2-tetraphenylethane were synthesized, the latter by a novel Rosenmund reduction of diphenylacetyl chloride. Apparatus used in studying an isotope effect in the decomposition of formic acid-C^{14} is illustrated, and results are discussed. Preliminary studies of a new method for the synthesis of C^{14}-carbonyl-labeled unsymmetrical benzils are summarized. Observations on the reaction of ThF_4 with PF_3, PF_5, and POF_3 gases in sealed tubes are reported briefly. Preliminary values of the magnetic moments of I^{129} and I^{127} are given. A decrease in the activity of a ZnO

catalyst for ethylene hydrogenation has been observed as a result of irradiation with Co^{60} γ rays. A circuit for a differential and integral pulse-height selector for the A-1 amplifier and field patterns in cylindrical proportional counters containing end-wall correcting sleeves, ring-type correction, or internal sample holder are shown. (D.E.B.)

1837 ORNL-1153(Del.)
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1951. Apr. 15, 1952. Decl. with deletions Mar. 4, 1957. 109p. Contract W-7405-eng-26. $16.80(ph OTS); $5.70(mf OTS).

Inorganic Chemistry. Anion and cation exchange of Zn in chloride and perchlorate solutions is described. Heat of solution and formation of Tc_2O_7, preparation of TcO_2, and magnetic studies of technetum compounds are given. Nuclear Chemistry. The tentative decay scheme of Ga^{67} is given. Mass-spectrographic fission-product gas yield curves are presented. The distillation of Tc with H_2SO_4 is described. Radio-Organic Chemistry. Experiments designed to determine the nature of the reactions of acetic acid induced by γ radiation have continued. The isotope effect in the carbonation of organometallic reagents, formic acid, formates, and decomposition of mercurous formate was studied. The possibly unsymmetrical addition of the elements of water across the $C^{12} = C^{14}$ triple bond of diphenyl (acetylene-1-C^{14}) was investigated. Studies on the mechanisms of organic reactions are presented. Rearrangements of α diketones are discussed. Chemistry of Separation Process. The removal of Pa^{233} from neutron irradiated ThF_4, extraction of Zr^{95} from 3M $HClO_4$ with dibenzoylmethane, adsorption of thenoyltrifluoroacetone and its uranyl chelate from organic solvents, and rate studies with ion exchangers are presented. Chemical Physics. The crystal structure of KHF_2, observed frequencies and quadrupole couplings for Cl^{35}, and measurement of the $C^{14}O_2$ concentration in a $C^{14}O_2$–$C^{12}O_2$ mixture are presented. Radiation Chemistry. Measurements of gas production from reactor irradiated UO_2SO_4, UO_2F_2 solution, and natural U, and effect of radiation on heterogeneous catalysts are described. Chemistry of the Solid State. Effects of radiation on crystal structure of lead oxide is described. Reactor Chemistry. The solubility of UO_3 in orthophosphoric acid solutions at 250°C, hydrogen-oxygen recombination in solutions, and solubilities of fission-product sulfates are described. (W.L.H.)

1838 SRO-14
Horizons, Inc., Cleveland.
PRODUCTION OF ELECTROLYTIC THORIUM CELL FEED BY A WET CHEMICAL METHOD. Process Report. Charles E. Fisher. Mar. 18, 1955. Decl. Mar. 18, 1957. 13p. Contract AT(30-1)-1335. (HZ-11; DPWR-148). $3.30(ph OTS); $2.40(mf OTS).

In order to produce a substantially oxide-free chloride, a specialized technique, based on the chemical characteristics of the ammonium thorium chloride complexes, has been found optimum. The procedure involves the formation of a solution of thorium chloride and ammonium chloride, evaporation of the solution to form a hydrated ammonium thorium chloride complex, dehydration of the complex by low-temperature drying, and ignition of the complex, after inter-mixture with an alkali chloride, to remove ammonium chloride and to form a thorium alkali chloride mixture for electrolysis. (L.T.W.)

1839 SRO-15
Horizons, Inc., Cleveland.
RESEARCH AND DEVELOPMENT IN THE FIELD OF THORIUM CHEMISTRY AND METALLURGY. Monthly Progress Report [for] March 15 thru April 15, 1955. James L. Wyatt. Apr. 26, 1955. Decl. Mar. 14, 1957. 24p. Contract AT(30-1)-1335. (HZ-18). $4.80(ph OTS); $2.70(mf OTS).

A transition program, eliminating most of the wet chemical techniques for the preparation of cell feed and replacing these with a high temperature chlorination process, was begun. Crushing tests on a Fitz mill were initiated and tentative conclusions are that this type of equipment is superior to a combination of jaw and roll crushing. Small scale chlorination experiments indicate the feasibility of pelletizing $ThOCO_3$ for feed to a continuous high-temperature chlorinator. (D.E.B.)

1840 TID-5193
New Brunswick Lab., AEC, N. J.
REPORT ON THE THORIUM PROGRAM FOR THE PERIOD ENDING MARCH 14, 1952. Decl. Mar. 5, 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

Countercurrent mixer-settler extraction experiments were continued. The distribution of the Th for each of the settler stages is tabulated. A spectrographic analytical report on the purity of the product is given. Data are also given on the distribution of tracer amounts of the rare earths between the aqueous and organic phases in the solvent extraction of thorium nitrate. (B.J.H.)

1841 TID-10041
North American Aviation, Inc., Downey, Calif.
CONFERENCE ON THE USE OF ORGANIC MATERIALS IN NUCLEAR REACTORS, AUGUST 5-6, 1953, DOWNEY, CALIFORNIA. R. L. Loftness, comp. Dec. 1, 1953. Decl. Mar. 9, 1957. 156p. Contract AT-11-1-GEN-8. $0.70(OTS).

The following papers were presented: thermal stability of aromatic hydrocarbons at 490°C; pyrolysis studies on organic compounds for reactor use in the range 465 to 500°C; melting points and viscosities of mixtures of diphenyl with its pyrolysis products; research on high-temperature liquids at NBS; effects of structure and functional groups on the radiolysis of organic compounds; certain effects of radiation types and dosage on the stability of organic fluids; radiation damage in organic polymers; effects of temperature on the radiation stability of aromatic hydrocarbons; stability of biphenyl and 1 Mev electron irradiation; analysis of the use of organic moderator in liquid Na cooled power reactor; cost chargeable to coolant in a biphenyl-cooled reactor; and engineering analysis of organic coolants in power reactors. (L.M.T.)

1842 Y-B31-273(Del.)
Oak Ridge National Lab., Y-12 Area, Tenn.
CLARITY OF BORATED WATER IN CONCRETE TANKS. H. P. House and C. D. Susano. July 24, 1951. Decl. Mar. 12, 1957. 6p. Contract W-7405-eng-26. $0.20(OTS).

It has been proposed, for the safe disassembly of equipment, large concrete tanks containing solutions of $K_2B_4O_7 \cdot 5H_2O$ or other salts of boron be used as a shielding solution. The disassembly is carried out beneath the surface of the liquid. Exposure tests were carried out in order to determine whether boron salt solutions would retain the required clarity when in contact with uncoated concrete. It was found that $K_2B_4O_7 \cdot 5H_2O$ retained its clarity. (W.L.H.)

Analytical Procedures

1843 LA-2025
Los Alamos Scientific Lab., N. Mex.
DETERMINATION OF RUTHENIUM IN PLUTONIUM. Karl S. Bergstresser. Mar. 1956. Decl. Apr. 1, 1957. 26p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

An analytical procedure for 0.04 to 1.6% Ru in Pu metal was developed. Dissolved samples were transferred as chlorides to a special glass still for separation of Ru as the tetroxide by distillation from boiling perchloric acid. The Ru distillate collected in 3N NaOH solution was precipitated with the aid of $Mg(OH)_2$ as carrier. After dissolution of the Ru–$Mg(OH)_2$ mixture in HCl, photometric measurements were made at 620 millimicrons, using thiourea as a color reagent. When the recommended equipment and colorimetric method were used, the standard deviation of a single measurement of Ru was 2 micrograms in the range of 40 to 400 micrograms for samples containing as much as 100 milligrams of Pu. No interference from such elements as Cr, Mo, Zr, Ce, or Co was observed. (auth)

1844 ORNL-788(Del.)
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1950. Oct. 4, 1950. Decl. with deletions Feb. 28, 1957. 78p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50 (mf OTS).

Ionic Analyses. Chemical methods are described for the determination of alkyl phosphates in the presence of U and for bromide and bromine in $NaBrO_3$. A colorimetric procedure for F_2 in impure solutions is being investigated. Polarographic methods for total Sb in an Sb^{124} solution and for Cd in vinylite samples are given. A procedure for the polarographic determination of U in the presence of orthophosphate or Fe is suggested. Radiochemical Analyses. The results of a program to determine the efficiency of krypton-filled G-M tubes for electromagnetic radiations of low energy are reported. The mass assignment and the thermal neutron cross section of Hg^{203}, and the half life, β_{max}, and thermal-neutron cross section for the production of Hg^{205} have been determined. The problems of the C^{14} assay are discussed. Procedures are reported for the determination of Ni^{59}, Ni^{63}, Nb^{95}, I^{125}, I^{126}, I^{131}, and Np^{237}. An ion-exchange method for the determination of possible impurities in phosphorus-bakelite samples is proposed, and a procedure for the electrodeposition of U^{233} has been tested. Homogeneous Reactor Chemical Control. Preliminary investigations of methods are given by which chemical control of the reactor solution would be possible. The results of tests conducted on the laboratory scale for the regeneration of chromic acid in the experimental homogeneous reactor solution are included. Optical and Electron Microscopy. Results of a study of the relation of inclusion to the corrosion attack on Be and Zr are given. An electron micrograph of colloidal Dowex resin is included. Methods Development. A procedure for the determination of O_2 in zirconium is reported, and a spectrographic method is suggested for the determination of airborne Tl. A method for the determination of N_2 in argon has been tested. (auth)

1845 ORNL-816
Oak Ridge National Lab., Tenn.
A PRELIMINARY SURVEY OF RADIOACTIVE CONSTITUENTS IN RAINWATER AT ORNL. W. A. Brooksbank, Jr., A. H. Emmons, J. W. Gost, and S. A. Reynolds. Dec. 4, 1950. Decl. Feb. 28, 1957. 47p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

A method was developed for the determination of gross changes in air contamination levels of Ce, Sr, Ru, Zr, Pu, and U by radiometric analyses of rain water. (C.W.H.)

1846 ORNL-955(Del.)
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 10, 1951. Mar. 28, 1951. Decl. with deletions Feb. 28, 1957. 110p. Contract W-7405-eng-26. $16.80(ph OTS); $5.70(mf OTS).

Ionic Analyses. An automatic titration method for the determination of iodides and chlorides in the presence of their oxyhalide salts was investigated. Work was continued on the automatic titration of U and Pu. Radiochemical Analyses. Progress is reported on Cd ratios for pile neutron capture to produce 225 d Ag^{110}, assay of low energy β emitters, Cd in vinylite resin, analysis of radioisotopes, analysis for heavy elements (Po^{84} to Cm^{96}), identification of radioelements, and ion exchange and Chromatography in radiochemical analysis. Spectrochemical Analysis. Spectrochemical methods were developed for performing the following porous cup technique: Ta in Nb, As in Ca, Ge in Cu, Zn in Cu, Mn in Be, Zm in H_2SO_4, Sn in H_2SO_4, and Y in Ca solution. Radiochemical Analysis. The HRE solutions were analyzed for total U, U^{4+}, Cr, Fe, Cl^-, S, and pH. Various other samples were submitted for analysis. Inorganic Preparations. Preparation of the following inorganic compounds are reported: thorium fluosilicate and related compounds; metallic Ni; Mn_2Sb; ferrous oxide; cobaltous fluosilicate; calcium fluosilicate; and lithium compounds. Optical and Electron Microscopy. An investigation of the micro characteristics of multilayer films found on pretreated stainless steel before and after immersion in 0.17M UO_2SO_4 solution containing 0.1M HNO_3 at 250°C is presented. (W.L.H.)

1847 ORNL-1129(Del.)
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1951. Feb. 26, 1952. Decl. with deletions Feb. 21, 1957. 93p. Contract W-7405-Eng-26. $15.30(ph OTS); $5.40 (mf OTS).

The following studies are reported: spectrophotometric determination of U in HRE solution and Purex streams; microdetermination of Al by colorimetric and fluorometric methods; polarography of Tc; spectrophotometric determination of Mo in spectrographic standards; vacuum fusion analysis of metals; efficiencies of scintillation gamma counters; purity of Zn^{65}; solvent extraction of Nb and Ta with methyldioctylamine in xylene; and determination of UF_3 by $Ce(SO_4)_2$ method and H_2 evolution method. (T.R.H.)

1848 TID-7003(Del.)
New Brunswick Lab., AEC, N. J.
CURRENT PROCEDURES FOR THE ANALYSIS OF UO_3, UF_4, AND UF_6. C. J. Rodden. Feb. 1956. Decl. with deletions Apr. 11, 1957. 132p. $3.50(OTS).

Standard analytical procedures are presented for the analysis of UO_3, UF_4, and UF_6. (W.L.H.)

1849 Y-1059
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
ANALYSIS OF LITHIUM METAL, HYDRIDE, AND HYDROXIDE. IV. PHOTOMETRIC DETERMINATION OF COPPER. H. A. Friedman. Mar. 21, 1953. Decl. Mar. 6, 1957. 10p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Copper in the range of 0 to 20 ppm may be determined colorimetrically in Li metal, hydride, and hydroxide by extraction of the diethyldithiocarbamate into iso-amyl alcohol. NH_4OH is added prior to extraction to deionize Fe and to prevent rapid fading of the developed color. If Ni is present in large enough concentrations to interfere, it may be removed by preliminary extraction of Ni dimethylglyoxime into chloroform. Li does not appear to affect the method significantly. At the 95% confidence level, the limits of error of the method for three Cu concentrations were: 0.16 μg/ml, ±26%; 2.16 μg/ml, ±6.0%; 2.66 μg/ml, ±4.5%. (auth)

Fluorine and Fluorine Compounds

1850 CF-52-8-163
Oak Ridge National Lab., Tenn.
MEASUREMENT OF THE THERMAL CONDUCTIVITY OF FLINAK. L. Cooper and S. J. Claiborne. Aug. 26, 1952. Decl. Feb. 20, 1957. 7p. Contract [W-7405-eng-25]. $1.80(ph OTS); $1.80(mf OTS).

The thermal conductivity of Flinak (11.5 mole % NaF, 42 mole % KF, 46.5 mole % LiF) was determined by use of a modified Deem-type apparatus. Three measurements were made in the temperature ranges 490 to 590°C, 567 to 670°C, and 634 to 747°C. (L.T.W.)

1851 CF-55-5-59
Oak Ridge National Lab., Tenn.
MEASUREMENT OF THE VISCOSITY OF COMPOSITION 78. S. I. Cohen and T. N. Jones. May 16, 1955. Decl. Aug. 14, 1957. 3p. Contract W-7405-eng-26. $1.80 (ph OTS); $1.80(mf OTS).

Viscosity measurements were made on Composition 78 (BeF_2–LiF–NaF; 28–16–56 mole %), and the viscosity was found to vary from about 7 centipoises at 575°C to about 2.9 centipoises at 800°C. The viscosity may be represented throughout this temperature range by $\mu = 0.105 \exp(3560/T)$, where T is in °K. (L.T.W.)

1852 CF-56-5-33(Del.)
Oak Ridge National Lab., Tenn.
MEASUREMENT OF THE VISCOSITY OF COMPOSITIONS 12, 14, AND 107. S. I. Cohen and T. N. Jones. May 9, 1956. Decl. with deletions Mar. 15, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The viscosity of Composition 12 or Flinak (NaF–LiF–KF; 11.5–46.5–42 mole %) varied from 9.1 centipoises at about 500°C to 1.95 centipoises at about 800°C and may be represented throughout this range by $\mu = 0.0391 \exp(4219/T)$, where T is in °K. The viscosity of Composition 14 or Fulinak (NaF–LiF–KF–UF_4; 10.9–44.5–43.5–1.1 mole %) varied from 8.8 centipoises at about 500°F to 1.8 centipoises at about 800°C and may be represented throughout this range by $\mu = 0.0348 \exp(4265/T)$. The viscosity of Composition 107 (NaF–LiF–KF–UF_4; 11.2–45.3–41–2.5 mole %) varied from 8.2 centipoises at about 525°C to 3.0 centipoises at about 700°C and may be represented throughout this range by $\mu = 0.0292 \exp(4507/T)$. (L.T.W.)

Laboratories and Equipment

1853 TID-7513(Pt. 2)
Division of Reactor Development, AEC.
FOURTH ATOMIC ENERGY COMMISSION AIR CLEANING CONFERENCE HELD AT ARGONNE NATIONAL LABORATORY, NOVEMBER 1955. Decl. Mar. 4, 1957. 31p. $0.35(OTS).

Air cleaning problems associated with the control of uranium and fluorine contamination in a gaseous diffusion plant are discussed. Special air cleaning and ventillating equipment for use during the machining of shapes from oralloy, which contains a high concentration of U^{235} and some U^{234} impurity, are described and illustrated photographically. Air cleaning and inert atmosphere ventilation systems and equipment for the ANL Fuel Fabrication Facility, for the fabrication and development of reactor fuel components containing Pu and U^{233}, are described and illustrated photographically. (See also TID-7513(Pt. 1)). (C.H.)

Radiation Chemistry

1854 HW-32405(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION STABILITY OF CARBON TETRACHLORIDE. R. E. Olson and K. L. Adler. July 12, 1954. Decl. with deletions Feb. 26, 1957. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The decomposition of CCl_4 containing TBP exposed to γ radiation is roughly proportional to the total radiation exposure. Excessive corrosion rates due to high Cl^- ion concentrations may be expected on stainless steel equipment exposed to solutions which have been in contact with CCl_4 at high radiation intensities. Corrosion may be particularly severe in equipment operated at high temperatures and in the presence of hydrogen ion. (auth)

Radiation Effects

1855 NAA-SR-MTA-24(Del.)
North American Aviation, Inc., [Downey, Calif.].
CORROSION OF "CROLOY" STEEL BY LIQUID BISMUTH UNDER CYCLOTRON IRRADIATION. N. S. Rasor and A. A. Epp. [1951?]. Decl. with deletions Apr. 16, 1957. 16p. $3.30(ph OTS); $2.40(mf OTS).

The proton beam from the Crocker 60 in. cyclotron incident on a liquid Bi–Croloy steel interface has been used to determine the effect of intense radiation on the rate of corrosion. The results indicate that under the specified atmosphere and temperature conditions there is no large effect on the rate of corrosion of Croloy steel by liquid Bi due to the presence of the radiation. A possible increase in the rate of wetting by Bi due to the radiation is indicated. Factors affecting the results observed are reviewed, and improvements in technique for future experiments suggested. (auth)

1856 TID-7007(Pt. 2(Del.))
Division of Reactor Development, AEC.
COMPILATION OF ORGANIC MODERATOR AND COOLANT TECHNOLOGY. Jan. 24, 1957. Decl. with deletions Mar. 15, 1957. 393p. $1.75(OTS).

A large amount of information is included on the effects of radiation on organic compounds. Particularly, discussions are included on topics such as the radiation stability of organic fluids, the stability of diphenyl under fast flux irradiation in a dynamic system, the radiation and thermal stability of ortho-, meta-, and para-terphenyls, and the radiation damage in organic materials in relation to the type of radiation. Extensive information is also given on the particular applications of organics to use in reactors. Included are detailed discussions on the design and feasibility of an MTR type power producer for remote locations, the analysis of costs attributable to coolant maintenance in a diphenyl cooled reactor, properties of organic coolants, preliminary studies of a hydrocarbon moderated and cooled reactor, the evaluation of organics as reactor moderator-coolants, an Organic Moderated Reactor Experiment, in-pile studies for the development of organic moderated reactors, and a nuclear design study of diphenyl moderated and cooled reactors. Other topics discussed include a study of the corrosion of natural U and Mg in diphenyl and the intermediate heat transfer system for use with Na cooled reactors. (D.E.B.)

1857 WAPD-RM-174
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

STABILITY OF SEQUESTERING AGENTS TO GAMMA RADIATION. Paul E. Brown and Philip W. Mathay. [1953?]. Decl. Mar. 9, 1957. 7p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

Considering the change in complexing capacity, both the sulfonated polystyrene and the sulfonated phenol formaldehyde solutions seem to possess adequate stability to gamma radiation for the proposed application. The loss in complexing capacity of polymerized acrylic acid due to gamma radiation would cause it to be less desirable than the others as a cleaning agent for a reactor vessel. No gum or other insoluble material deposited from any of the solutions irradiated. The slight gas pressure developed by these materials under radiation should not be a serious deterrent to their use as cleaning agents. (auth)

Rare Earths and Rare-earth Compounds

1858 CF-56-7-36

Houdry Process Corp. Research and Development Labs., Linwood, Penna.

SECOND QUARTERLY REPORT, 1956 ON: 1. PREPARATION OF THORIA SOLS. II. MEASUREMENT OF PHYSICAL PROPERTIES OF SOLS AND SLURRIES. J. J. Donovan. 17p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 904. $3.30(ph OTS); $2.40 (mf OTS).

Attached to this report is a letter from G. A. Mills, dated July 6, 1956.

Progress is reported in the study of ThO_2 sols and related systems and in the development of methods for measuring the physical properties of sols and slurries. (W.L.H.)

1859 ISC-35

Ames Lab., Ames, Iowa.

QUARTERLY SUMMARY RESEARCH REPORT FOR JULY, AUGUST, AND SEPTEMBER 1948. E. I. Fulmer. Decl. Mar. 28, 1957. 40p. Contract [W-7405-eng-82]. $6.30(ph OTS); $3.00(mf OTS).

Separation Procedures

1860 A-1051

Mallinckrodt Chemical Works, St. Louis.

BROWN OXIDE BY-PRODUCT RECOVERY. [Part] VI. J. W. Barnes, T. C. Furnas, J. V. Opie, and G. C. Reid. Oct. 28, 1943. Decl. Feb. 12, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

Three methods for the recovery of UO_2 from sludge are suggested; carbon reduction, and two H_2O leaching, HNO_3 digestion, $UO_2(NO_3)_2$ separation procedures. (D.E.B.)

1861 BKC-2828(Del.)

Blaw-Knox Construction Co., Pittsburgh.

SHIELDING REPORT. PROJECT "KAPL R" FOR GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK. Nov. 15, 1948. Decl. with deletions Feb. 13, 1957. 179p. $27.30(ph OTS); $8.10(mf OTS).

The engineering design of a pilot plant employing the Redox Process for the separation of Pu from U has been undertaken. This report is intended to summarize one phase of the project, the shielding program. This program has involved the design of protective structures and the incorporation of necessarily elaborate devices and techniques for the safe handling of radioactive materials. A detailed set of calculations was prepared to determine barrier thickness required for various applications. In making these determinations an analysis of each cell was made in plan and elevation, using the most unfavorable position for the receptor as the basis for calculation. Sections of the report cover theory, results, and calculations, respectively. (D.E.B.)

1862 BNL-345

Brookhaven National Lab., Upton, N. Y.

LIQUID METAL FUEL REACTOR FUEL PROCESSING STUDIES. C. Raseman, R. Bauman, and J. Weisman, comps. Jan. 1955. Decl. Mar. 18, 1957. 22p. (LMFR-9). $0.75(OTS).

Small scale studies and loop tests were carried out on Bi–Ce–U/LiCl–KCl systems to estimate the effect of U and Ce concentration on the respective distribution coefficients, the effect of metal-metal ion additives, the effect of redox additives, and the distribution coefficients of the nonvolatile fission products obtained by pile irradiation. The corrosion of stainless steel by liquid Bi–U alloys was investigated. (C.W.H.)

1863 CCCO-422

Catalytic Construction Co., Philadelphia.

PROCESS ENGINEERING REPORT ON THORIUM SEMI-WORKS PLANT FOR THE FEED MATERIALS PRODUCTION CENTER, FERNALD, OHIO. Job No. 3542. H. H. Bulkowski, J. W. Delaplaine, G. V. Holby, N. R. Natale, W. M. Reiter, and B. J. Roe. Jan. 31, 1952. Decl. Feb. 16, 1957. 69p. $0.55(OTS).

Process information required for the layout and detailed mechanical design of a Th production plant is presented. The proposed plant was to prepare Th metal ingots starting with mantle-grade Th nitrate. No provision for fabricating the Th ingots into rods was included. (C.H.)

1864 CF-47-10-89

Clinton Labs., Oak Ridge, Tenn.

PHASE SEPARATION BY ELECTRICAL CONDUCTIVITY (ELECTRODE DESIGN). Final Report for the Period October 15, 1946–November 18, 1946 on Semi-Works Problem No. TX5-11-11. Clyde D. Watson. [1947]. Decl. Feb. 16, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

An electrode was designed for use in the separation of immiscible liquid phases by utilizing the difference in electrical conductivity of the two phases. This was successfully demonstrated, providing an emulsion was not present, for the organic-aqueous phases in the "23" and "25" batch solvent extraction processes. The electrode was constructed of stainless steel piping, packed and insulated with "Teflon" and no failures attributable to the electrode were encountered in test runs or in the actual production of "23" in Cell #4 of the Semi-Works. With the electrode 6" below the discharge side of a $\frac{1}{4}$" decant tube and at an aqueous decantation rate of 1.64 L/min., the average phase separation for the extraction step of the "23" Process was 42 ml of the aqueous phase remaining with the organic phase and 30 ml of the organic phase decanted with the aqueous phase. Under the same conditions and for the "25" Process, the average phase separation was 40 ml of the aqueous phase remaining with the organic phase and 60 ml of the organic carried over with the aqueous phase. One other type electrode was designed and tested, but lack of structural strength or low resistance to solvent action prohibited its use. (auth)

1865 CF-47-10-230

[Oak Ridge National Lab., Tenn.]

1200 AREA PILOT PLANT MANUAL OF OPERATIONS. D. G. Reid and N. J. Rigstad. Sept. 1, 1947. Decl. Feb. 14, 1957. 225p. Contract [W-7405-eng-26]. $36.30(ph OTS); $10.20(mf OTS).

A manual was prepared as an aid in correctly operating the equipment and facilities constructed for the purpose of solving various problems pertaining to the 25 Process.

Included are discussions of the chemistry of the process, descriptions of the buildings and equipment for carrying out the various steps, and operating procedures and safety rules. (D.E.B.)

1866 CF-49-11-328(Del.)
Oak Ridge National Lab., Tenn.
ORIENTATION MANUAL FOR 23 PILOT PLANT. D. E. Ferguson and R. J. Klotzbach. Nov. 29, 1949. Decl. with deletions Feb. 14, 1957. 38p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

This report summarizes the status of 23 Process chemistry, gives a description of the 23 pilot plant, including data on the dibutyl cellosolve, disopropyl ether, and hexone processes; and discusses laboratory cleanup and concentration; building design; cell equipment; construction materials; instrumentation; makeup area equipment; samplers and jets. Flowsheets are included illustrating process equipment layout, solvent recovery equipment, and column temperature control. (T.W.S.)

1867 CF-55-9-150
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT FOR SEPTEMBER 1955. W. K. Eister. Decl. Feb. 18, 1957. Contract [W-7405-eng-26]. $0.45(OTS).

Exer-Moving Bed Reactor Studies. Studies were continued in the moving-bed conversion of starch-deficient UO_3 pellets to carbon-free UF_4 and the removal of residual C from UF_4 pellets. An economic evaluation of the Fluorox Process was made. A small moving-bed reactor was constructed to test the oxidation step of the Fluorox Process. HR Fuel Reprocessing. Studies were continued on hydroclone corrosion, neodymium precipitation, temperature distribution in hydroclone underflow pots, determination of the boiling characteristics of UO_2SO_4 solution, and design and operation of pumps and valves for the plants. Hope Project. The feasibility of using hydroclones for the recovery of spent organic solvents was investigated. Studies were continued on continuous fumeless U dissolution and pulse pumping techniques. Metallex. A thermodynamic study was made of the chlorination of $Th(C_2O_4)_2$. Results of the dry-salt reaction and vapor-phase reaction studies are reported. The purification of $ThCl_4$ by leaching with C_2H_5OH was investigated. Ore Processing. The 12-in. Higgins contractor is being installed at Grand Junction for slurry testing. Plutonium Producer Blanket Processing. The UO_2SO_4 blanket processing corrosion loop is described. 25 Process Assistance Program. Studies were completed on the slab dissolver operation for Savannah River fuel elements. Results are reported of solvent extraction and stripping studies. Power Reactor Fuel Reprocessing. A tentative flowsheet for the mechanical handling of fuel elements is presented. Studies were initiated on the dissolution of stainless steel elements in molten Al. Thorex. Extraction and stripping studies were made on the Thorex second Th cycle. (C.W.H.)

1868 CF-55-11-97
Oak Ridge National Lab., Tenn.
PROPOSAL FOR "25" OR THOREX WASTE DISPOSAL: SELECTIVE RECOVERY OF FISSION PRODUCTS IN RELATION TO THE LONG-RANGE ASPECTS OF CHEMICAL WASTE ECONOMICS. A. T. Gresky and R. P. Wischow. Nov. 17, 1955. Decl. Mar. 4, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Laboratory data and a preliminary flowsheet for partial recovery of fission products from Thorex and/or "25" process waste streams are presented for evaluation. The flowsheet permits significant separation and concentration of fission products and would provide suitable source materials for a radioisotopes separation plant. Residual wastes from this process will be significantly improved with respect to biological hazards and may thus be more susceptible to economic permanent disposal. (auth)

1869 CF-56-8-109
Oak Ridge National Lab., Tenn.
STATUS REPORT FOR CHEMICAL DEVELOPMENT, SECTIONS A AND B [FOR] WEEK ENDING AUGUST 3, 1956. R. E. Blanco and D. E. Ferguson. Aug. 13, 1956. Decl. Mar. 12, 1957. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

1870 CF-56-9-95(Del.)
Oak Ridge National Lab., Tenn.
STATUS REPORT FOR CHEMICAL DEVELOPMENT SECTIONS A AND B: WEEK ENDING SEPTEMBER 7, 1956. R. E. Blanco and D. E. Ferguson. Sept. 21, 1956. Decl. with deletions Mar. 13, 1957. 14p. [Contract W-7405-eng-26.] $3.30(ph OTS); $2.40(mf OTS).

1871 CF-56-10-7(Del.)
Oak Ridge National Lab., Tenn.
STATUS REPORT FOR CHEMICAL DEVELOPMENT SECTIONS A AND B: WEEK ENDING SEPTEMBER 21, 1956. R. E. Blanco and D. E. Ferguson. Oct. 1, 1956. Decl. with deletions Mar. 13, 1957. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

1872 CF-56-10-128(Del.)
Oak Ridge National Lab., Tenn.
STATUS REPORT FOR CHEMICAL DEVELOPMENT, SECTIONS A AND B: WEEK ENDING OCTOBER 19, 1956. R. E. Blanco and D. E. Ferguson. Oct. 30, 1956. Decl. with deletions Mar. 13, 1957. 13p. $3.30(ph OTS); $2.40 (mf OTS).

1873 CN-2492
[Chicago. Univ. Metallurgical Lab.]
ETHER EXTRACTION AS A PORTION OF A SEPARATIONS PROCESS. Program Authorization 281-ML-55-2b. R. S. Buffum, R. E. Clark, D. K. Duffey, G. F. Quinn, and J. B. Tepe. Dec. 14, 1944. Decl. Feb. 15, 1957. 29p. Contract W-7401-eng-37. $4.80(ph OTS); $2.70(mf OTS).

Lab and semi-works investigations of a diethyl ether extraction method for separating U and Pu are reported. (T.R.H.)

1874 CN-3685
Argonne National Lab., Lemont, Ill.
THE RECOVERY OF NEPTUNIUM IN THE BISMUTH PHOSPHATE PROCESS FOR THE SEPARATION OF PLUTONIUM. H. H. Hyman. Nov. 6, 1946. Decl. Feb. 18, 1957. 7p. Contract W-31-109-eng-38. $1.80(ph OTS); $1.80(mf OTS).

By employing slightly altered conditions in three steps of the Bismuth Phosphate Process, it is possible to recover as much as 80% of the Np^{237} produced in the reactor. The modifications suggested do not impair Pu yield in the process. (auth)

1875 FMPC-1
Catalytic Construction Co., Philadelphia.
PROCESS ENGINEERING MEMORANDUM ON TBP EXTRACTION AND PURIFICATION OF THORIUM EVALUATION OF EXTENDED RUNS AT BMI. Job No. 3542 of the Feed Materials Production Center — Fernald, Ohio. John W. Delaplaine and Nicolo R. Natale. June 3, 1952. Decl. Mar. 12, 1957. 29p. Contract AT(30-1)-1060. $4.80(ph OTS); $2.70(mf OTS).

Data are presented from the extended batch-countercurrent and pilot plant runs on the TBP extraction of Th from mantle grade material. Experiments were carried

out to demonstrate an operable process for 99.9% recovery of Th, specification purity and mechanical operability. In addition, both the batch countercurrent and the pilot plant runs were carried through a very large number of volume changes to assure the attainment of equilibrium conditions. These runs demonstrated conclusively that specifications can be met and that the extraction process using 30% TBP – 70% Solvesso as an extractant and HNO_3 as a salting agent is commercially sound. (auth)

1876 FMPC-150(Del.)
National Lead Co. of Ohio, Cincinnati.
HEALTH AND SAFETY ASPECTS OF NEW MATERIALS FEED PLANT FOR THORIUM PRODUCTION. O. R. Magoteaux, E. W. Mautz, and T. C. Runion. Mar. 5, 1953. Decl. Mar. 9, 1957. 16p. Contract AT(30-1)-1156. $0.30(OTS).

The health and safety aspects of the Th production plant are presented for each step of the operation for the orientation of new employees. (auth)

1877 FMPC-532
National Lead Co. of Ohio, Cincinnati.
THE RECOVERY OF URANIUM FROM ETHER EXTRACTION WASTE RESIDUES (AM-7). Progress Report. E. R. Johnson, R. L. Doyle, W. H. Malotte, and E. O. Rutenkroger. Jan. 21, 1955. Decl. Mar. 18, 1957. 47p. Contract AT(30-1)-1156. $7.80(ph OTS); $3.30(mf OTS).

The leaching of uranium values from AM-7 (the cake resulting from the lime neutralization of raffinates resulting from MCW ether extraction of Belgian Congo ores) by both sulfuric acid and a mixture of sodium carbonate and bicarbonate is described. The results of laboratory studies of the recovery of uranium from the acid leach solutions by (1) fractional precipitation, (2) precipitation of the uranium as a phosphate, and (3) ion exchange are presented. Recovery of uranium from carbonate leach solutions by precipitation with (1) sulfuric acid and (2) sodium hydroxide is also described. The results of denitration studies in which AM-7 was (1) water leached, (2) air roasted, and (3) sulfate roasted are presented. (auth)

1878 H-5.320.9
Tennessee Eastman Corp., Oak Ridge, Tenn.
THE HF-H_2-LEACH (HFRL) TREATMENT FOR RECOVERY OF URANIUM FROM RESIDUES. PART IV. PLANT SCALE DEVELOPMENT. A. G. Blasewitz and G. H. Clewett. Jan. 27, 1947. Decl. Feb. 23, 1957. 23p. Contract W-7401-eng-23. $4.80(ph OTS); $2.70(mf OTS).

Pilot-plant studies of the HFRL process for the recovery of uranium from refractory residues were continued. The HFRL process consists of an initial and final hydrofluorination at 600°C for a total time of 4 hr, and an interim H_2 reduction at 600°C for 2 hr; the resulting residue is leached twice with a HNO_3–$Al(NO_3)_3$ solution and a third time with HNO_3 alone. Recovery values of 95 to 98% were obtained. (C.W.H.)

1879 HW-19949
Hanford Works, Richland, Wash.
PROPERTIES OF THE SYSTEM – URANYL NITRATE – ALUMINUM NITRATE–NITRIC ACID–WATER–HEXONE. PART VII. DISTRIBUTION OF URANYL NITRATE, NITRIC ACID, PLUTONIUM(IV) AND PLUTONIUM(VI) FROM 0 TO 60°C. L. L. Burger, I. M. Rehn, and C. M. Slansky. Feb. 1, 1952. Decl. Apr. 3, 1957. 24p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

1880 HW-33682
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PARTITION OF DIBUTYL PHOSPHATE. Leland L. Burger. Nov. 8, 1954. Decl. Apr. 1, 1957. 11p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The partition of dibutyl phosphate (DBP) between aqueous systems and 20% TBP in Shell Spraybase has been determined over the concentration range of 10 to 10^4 ppm DBP. (C.H.)

1881 ISC-115
Ames Lab., Ames, Iowa.
SOLVENT EXTRACTION OF SOLUTIONS CONTAINING RARE EARTHS. PREPARATION OF THORIUM COMPOUNDS FROM MONAZITE BY SULFURIC ACID DECOMPOSITION AND SOLVENT EXTRACTION. M. E. Whatley and G. L. Bridger. June 30, 1950. Decl. Feb. 26, 1957. 44p. Contract W-7405-eng-82. $0.40(OTS).

An investigation was made of the feasibility of producing pure Th compounds from monazite sand by a process involving the digestion of the sand with H_2SO_4 and separation of Th from the rare earths by solvent extraction. Direct extraction was not practicable. Precipitation of the sulfate from the system with lime and HNO_3 was tried and found to be partially successful but impracticable because of the large losses of Th by occlusion in the precipitate. A successful method for producing tributylphosphate-extractable solution was found, consisting in neutralizing the original solution to precipitate the heavy metals as phosphates, and, after filtering and washing, dissolving this precipitate in HNO_3. (auth)

1882 ISC-134(Del.)
Ames Lab., Ames, Iowa.
I. PROCESS FOR PRODUCTION OF PURE THORIUM AND URANIUM NITRATE FROM MONAZITE. G. L. Bridger, K. G. Shaw, and M. E. Whatley. II. PURIFICATION OF THORIUM NITRATE AND THE SUBSEQUENT PRODUCTION OF THORIUM OXIDE. H. A. Wilhelm, W. D. Tucker, R. H. Giffen, and R. W. Fisher. Jan. 15, 1951. Decl. with deletions Feb. 26, 1957. 35p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

A process developed for the production of pure Th and U nitrates from monazite sand is described. The process consists of acid digestion, neutralization, and purification of Th-rich and U-rich fractions. Essentially complete recovery of Th and U as high-purity nitrates can be obtained. The steps in the purification of $Th(NO_3)_4$ and production of ThO_2 are also given. (D.E.B.)

1883 ISC-170
Ames Lab., Ames, Iowa.
PRODUCTION OF PURE THORIUM AND URANIUM COMPOUNDS BY THE ACID DISSOLUTION OF MONAZITE SAND. G. L. Bridger, K. G. Shaw, M. E. Whatley, and J. Bochinski. Sept. 21, 1951. Decl. Mar. 27, 1957. 37p. Contract W-7405-eng-82. $0.40(OTS).

The process for production of pure Th and U compounds has been improved and developed to the pilot-plant stage. This process consists of digestion of the monazite in H_2SO_4, dilution of the digested mass with H_2O, fractional neutralization with NH_3 in three stages, and producing Th-rich, rare-earth-rich, and U-rich fractions. The Th-rich and U-rich fractions are purified by solvent extraction, using tributyl phosphate as the solvent, while the rare-earth-rich fraction is digested in caustic, oxidized, and leached to extract the Ce. The process design variables investigated to date are discussed, and the proposed operating conditions are substantiated by the experimental data presented. A pilot plant is under construction. (D.E.B.)

1884 KLX-1617
Vitro Corp. of America, New York.
DECONTAMINATION OF UO_2SO_4 SOLUTIONS (57-C).

Project Summary [for] April 1, 1952–June 30, 1953. Job 57. 40p. Contract AT(11-1)-217. $0.35(OTS).

Studies have been made on ion exchange resin decontamination of U from spent homogeneous reactor UO_2SO_4 fuels, on carrier precipitation to supplement the resin decontamination, and on inorganic adsorbent removal of fission product rare earth ions from short cooled UO_2SO_4–D_2O fuel solution (to permit direct recycle to the reactor). Total fission product separation factors obtained in the ion exchange resin and carrier precipitation studies (before the major emphasis was placed on rare earth removal) are reported. The capacity of a number of inorganic agents for removal of rare earths from uranium in UO_2SO_4 solution is described together with their solubilities in the solution. The agents having the best combination of rare earth capacity, low uranium removal and minor effects on other ions are: calcium fluoride at 100°C or less and garnet (calcium iron silicate) at 250°C. (auth)

1885 LA-1861

Los Alamos Scientific Lab., N. Mex.

EXTRACTION OF AMERICIUM NITRATE WITH TRIBUTYL PHOSPHATE. K. A. Walsh. Jan. 4, 1955. Decl. Apr. 1, 1957. 31p. Contract W-7405-eng-36. $0.35(OTS).

The extraction of $Am(NO_3)_3$ with TBP has been investigated for aqueous solutions containing $NaNO_3$ and HNO_3. $Am(NO_3)_3$ is found in the organic phase as free molecules or ions and as the complex $Am(NO_3)_3 \cdot 3TBP$. Aqueous solutions containing HNO_3 introduce a competitive factor through the formation of a $TBP \cdot HNO_3$ complex in the solvent layer. In addition, $Am(NO_3)_3$ is complexed in the aqueous phase by HNO_3 as $HAm(NO_3)_4$. The equilibrium expressions for the prevailing reactions in the solvent extraction process have been combined to give the extraction coefficient,

$$\Sigma_a^n = \frac{\Sigma Am,\ org}{\Sigma Am,\ aq} = \frac{0.0109(NO_3^-)^3 + 0.00653(NO_3^-)^3\ (TBP)^3}{1 + 0.038\ [H^+][NO_3^-]^4}$$

The constants were evaluated for systems containing 1M to 5M $NaNO_3$ and 2M to 5M HNO_3 so that the activity coefficient of $Am(NO_3)_3$ remained nearly constant. (auth)

1886 LA-1991

Los Alamos Scientific Lab., N. Mex.

PURIFICATION AND CONCENTRATION OF SOLVENT EXTRACTED PLUTONIUM BY OXALATE PRECIPITATION. W. J. Maraman, A. J. Beaumont, R. L. Nance, J. C. Roybal and R. S. Winchester. Jan. 1956. Decl. Apr. 1, 1957. 12p. Contract [W-7405-eng-36]. $0.25(OTS).

A production-scale procedure for purifying and concentrating Pu contained in the stripping solution from a TBP extraction process is described. Conclusions from exploratory tests on variables affecting the efficiency are included. (auth)

1887 LA-2037

Los Alamos Scientific Lab., N. Mex.

PROCESS DEVELOPMENT STUDIES FOR RECOVERING Ba^{140} FROM IRRADIATED ENRICHED-URANIUM RODS. John W. Schulte. Mar. 1956. Decl. Apr. 2, 1957. 14p. Contract W-7405-eng-36. $0.20(OTS).

A chemical process using precipitation and filtration techniques was developed to separate Ba^{140} and other fission products from irradiated enriched uranium-stainless steel fuel pins. (auth)

1888 LAMS-1245

Los Alamos Scientific Lab., N. Mex.

THE DECONTAMINATION OF URANIUM FROM FISSION PRODUCTS BY THE USE OF THE URANYL OXALATE PRECIPITATION REACTION. B. L. Kelchner. May 10, 1951. Decl. Apr. 12, 1957. 27p. Contract W-7405-eng-36. $0.35(OTS).

Decontamination factors of the order of 10^4 were obtained for β and γ emitters present as fission products when U was precipitated from 50 mc activity level solutions as uranyl oxalate under normal U yield conditions for three cycles (~60%). Factors of the order of 10^3 were obtained by the use of this reaction with similar solutions under relatively high U yield conditions for three cycles (~90%). The U peroxide precipitation reaction proved to be of no value on such solutions, yielding decontamination factors of only 17.1 for β emitters and 1.2 for γ emitters for three cycles. (auth)

1889 LWS-22879(Del.)

California Research and Development Co., Livermore, Calif.

RADIATION EFFECTS IN AQUEOUS PROCESSING OF THE FBR. R. E. Elson and B. Rubin. May 6, 1953. Decl. with deletions Feb. 27, 1957. 10p. (D-F-14). $1.80(ph OTS); $1.80(mf OTS).

Aqueous processing is possible for the FBR core and blanket or the core alone. The most stringent conditions were considered: nearly saturated UNH, no loss of activity in off gases, and no cooling. A more realistic evaluation of these factors will lower the levels of activity, however, there are a large number of unknowns whose effects must be known and methods of overcoming deleterious effects will have to be determined. (F.S.)

1890 M-2761

[Yale Univ., New Haven.]

DISTRIBUTION OF My [RADIUM] IN NITRIC ACID DIGESTIONS OF PITCHBLENDE. QUALITATIVE NOTES ON FILTERABILITY OF GANGUES. Progress Report. Henry C. Thomas, Andrew S. Tomcufcik, and James L. Miller. [nd]. Decl. Mar. 6, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

Three groups of experiments were carried out to determine the distribution of Ra in HNO_3 digestion of rich pitchblende ores. The various experiments were designed to determine the effect of washing on the removal of Ra from the gangue, effect of excess HNO_3 and time of digestion on the removal of Ra from the ore, and effect of the concentration of HNO_3 on the extraction of Ra. (W.L.H.)

1891 MCW-230

Mallinckrodt Chemical Works, St. Louis.

A STUDY OF THE REMOVAL OF BORON FROM ETHER SOLUTIONS FOR URANYL NITRATE BY SPRAY WASHING WITH DISTILLED WATER. K. Eckberg. Oct. 28, 1949. Decl. Apr. 8, 1957. 10p. $4.80(ph OTS); $2.70 (mf OTS).

1892 MLM-554(Del.)

Mound Lab., Miamisburg, Ohio

REPORT FOR LIQUID WASTE DISPOSAL RESEARCH; NOVEMBER 13, 1950 TO MARCH 5, 1951. Apr. 9, 1951. Decl. with deletions Feb. 26, 1957. 9p. Contract AT-33-1-gen-53. $1.80(ph OTS); $1.80(mf OTS).

The removal of radioactivity from liquid wastes of the TBP process is being investigated with the ultimate objective of decontaminating these solutions to a value low enough to discharge to the ground or to local streams without fear of creating a hazard. Certain solid-liquid separation problems are presented involving the removal of ferrous sulfide, ferrous ferrocyanide, ferrous hydroxide, and calcium phosphate precipitates from solution. Studies have been initiated to determine the necessary data pertaining to each of the separation methods to make possible a proper selection when the final decontamination process has been developed. Such methods include filtration, sedimentation, and centrifugation. (D.E.B.)

1893 MLM-716(Rev.(Del. 2))
Mound Lab., Miamisburg, Ohio.
TECHNICAL ACTIVITIES QUARTERLY REPORT THROUGH JUNE 17, 1952. Decl. with deletions Mar. 18, 1957. 25p. Contract AT-33-1-GEN-53. $4.80(ph OTS); $2.70(mf OTS).

1894 N-422
[Chicago. Univ. Metallurgical Lab.]
CHEMICAL WORK NEEDED ON BISMUTH PHOSPHATE PROCESS PREPARATORY TO HANFORD OPERATION. Oct. 7, 1946. Decl. Feb. 27, 1957. 2p. (MUC-GTS-357). $1.80(ph OTS); $1.80(mf OTS).

A list is presented of chemical studies suggested to obtain information needed preparatory to setting the conditions for operation of the Bismuth Phosphate Process. The list includes problems in fundamental research, process development, semiworks, and plant operation. No results are included. (C.H.)

1895 NYO-112(Del.)
New York Operations Office, AEC.
SURVEY OF PROCESSES FOR RADIUM RECOVERY FROM PITCHBLENDE ORES. A. B. Babcock, Jr. [1950]. Decl. with deletions Feb. 28, 1957. 59p. $9.30(ph OTS); $3.60 (mf OTS)

The development of processes at various AEC laboratories for the recovery of Ra from pitchblende ores is discussed. Cost estimates and flowsheets are included. (C.W.H.)

1896 NYO-1352
Mallinckrodt Chemical Works, St. Louis.
RESEARCH AND DEVELOPMENT PROGRESS REPORT. A. E. Ruehle and W. M. Leaders. Jan. 15, 1953. Decl. Mar. 2, 1957. 180p. Contract W-14-108-eng-8. $28.80 (ph OTS); $8.40(mf OTS).

Progress is reported on the following studies: U removal from UO_2NO_3 solutions by use of long-chain phosphate esters dissolved in wax, ether extraction of various aqueous feeds by use of a 4-in. diameter jet mixer column, continuous denitration of raffinate, high U_3O_8 and UO_2 content in MCW UF_4, casting of U metal, U metal by bomb reduction, hydrolysis of U metal, dissolution of U metal, recovery of U and HF from MgF_2 bomb slag, de-etherization of raffinate, and porosity in U metal. (L.T.W.)

1897 NYO-5146
Mallinckrodt Chemical Works, St. Louis.
REMOVAL OF MOLYBDENUM IN PROCESSING AAA [PITCHBLENDE] ORE; LABORATORY RESEARCH DURING PERIOD OF AUGUST 1, 1945 TO OCTOBER 31, 1945. A. E. Ruehle, E. Dodge, and T. C. Furnas. Nov. 1945. Decl. Mar. 7, 1957. 158p. $39.60(ph OTS).

Four methods for the removal of Mo in processing pitchblende ores containing 25 to 65% U_3O_8 are extensively described. The methods are entitled: The Charcoal Methods, The Xanthate and Other Extraction Methods, The Polyhydric Alcohol Methods, and The Iron-Phosphate Complex Methods. Of the four methods only one is worth consideration as an alternative to the double extraction method. The iron method can compete as to cost and is simple to use. The recommendations made are to continue with plans to use the double extraction, test the iron method in the pilot plant columns, and hold the iron method as an alternative or supplement to the double extraction. (C.J.E.)

1898 ORNL-962(Del.)
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, PILOT PLANT SECTION REPORT FOR NOVEMBER 1950–JANUARY 1951. H. K. Jackson. Mar. 8, 1951. Decl. with deletions Mar. 1, 1957. 37p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Flowsheets, equipment, and programs for pilot-plant development of Purex and TBP Processes are summarized. (auth)

1899 ORNL-980
Oak Ridge National Lab., Tenn.
DRY FLUORIDE PROCESS STATUS REPORT. R. E. Leuze. Mar. 27, 1951. Decl. Mar. 1, 1957. 36p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Uranium hexafluoride was prepared by the direct combination of irradiated U metal with elemental F_2 and subsequently decontaminated by absorption, filtration, and sublimination on a laboratory scale. (L.M.T.)

1900 ORNL-1638(Del.)
Oak Ridge National Lab., Tenn.
A CHEMICAL REPROCESSING PLANT FOR A NUCLEAR POWER ECONOMY. R. A. Charpie, J. Halperin, R. J. Klotzbach, J. R. McWherter, F. Nelson, E. L. Nicholson, C. H. Odom, R. W. Stoughton, E. P. Wigner, and H. R. Zeitlin. Feb. 5, 1954. Decl. with deletions Feb. 25, 1957. 165p. Project Hope. Contract W-7405-eng-26. $0.70 (OTS).

The results of the Hope Project, a completely rationalized reprocessing plant, are summarized. An MTR type fuel element was adopted, with U^{233} replacing the U^{235}, and a fuel processing rate of 5.5 kg equivalent of U^{233} per day. The chemical process chosen was solvent extraction, using TBP in Amsco. The Hope plant features continuous dissolving; relaxed, yet safe, criticality criteria; sampling only for process control; a realistic approach to waste storage; and a new operating-maintenance philosophy. It was felt that with the process outlined enriched fuel elements could be reprocessed for about one dollar per gram. (L.M.T.)

1901 SOD-19
Standard Oil Development Co., Elizabeth, N. J.
REMOVAL OF NITRIC ACID FROM AQUEOUS REDOX SOLUTIONS BY DISTILLATION. R. C. Morbeck and C. H. Worsham. July 29, 1949. Decl. Mar. 4, 1957. 14p. Contract AT-30-3-GEN-3. $3.30(ph OTS); $2.40(mf OTS).

1902 SRO-21
Horizons, Inc., Cleveland.
RESEARCH AND DEVELOPMENT IN THE FIELD OF THORIUM CHEMISTRY AND METALLURGY. Monthly Progress Report [for] April 16 to May 15, 1955. James L. Wyatt. May 25, 1955. Decl. Mar. 14, 1957. 24p. Contract AT(30-1)-1335. (HZ-25).

A continuous belt drier capable of handling 1000 lbs of oxycarbonate per day was completed, installed, and operated to produce a satisfactory product for chlorination. An experimental chlorinator was also completed. All necessary parts were completed for the fabrication of Horizons' Mark VI continuous electrolytic cell. Evaluations of oxycarbonate materials for chlorination with varying chlorinating agents were made, and many of the variables such as water content and CO_2 values were established. Extremely ductile rods were obtained from the direct extrusion of Th metal powder. Plans were completed for the Mark XXVI electrolytic cell. Work was continued toward the development of a semi-continuous operating electrolytic cell of 7500-a rated capacity. (D.E.B.)

1903 TID-10002
California. Univ., Berkeley. [Radiation Lab.]
THE CHELATE PROCESS I. J. R. Thomas and H. W. Crandall. Dec. 12, 1946. Decl. 14, 1957. 58p. Contract W-7405-eng-48b. $0.40(OTS).

The chelate process for the extraction and decontamination of plutonium has been investigated. The process is designed as an alternate process for the Hanford type operation. The basic chemical factors have been studied and two flowsheets have been developed and tested for recovery of plutonium. An over-all yield of plutonium in excess of 99% is reported for one flowsheet using benzene as the organic solvent and 98.5% when toluene was substituted for benzene. The general factors involved in establishing all details of the flowsheets are thoroughly discussed and decontamination studies are indicated to complete the study in the present equipment. (auth)

1904 TID-10143

New Brunswick Lab., AEC, N. J.

QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING MARCH 31, 1953. C. J. Rodden. Decl. Mar. 8, 1957. 74p. $0.55(OTS).

The recovery of Th from monazite, recovery of U from discard slag, conversion of U to UF_4 by gaseous HF, and the liquid-liquid extraction of H_3BO_3 using aliphatic alcohols are discussed. The work in analytical chemistry included the x-ray-diffraction analysis of minerals from the Belgian Congo, the colorimetric determination of Th in uraninite and similar ores, and the determination of rare earth elements in UO_3. Flame photometric determination of Na, Li, and K in Be solutions were investigated. (W.L.H.)

1905 WIN-31

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

A SOLVENT LEACHING PROCESS FOR THE PRODUCTION OF HIGH-PURITY URANIUM PRODUCTS DIRECTLY FROM LOW-GRADE ORES. P. Galvanek, Jr. and M. S. Pelland. Dec. 9, 1955. Decl. Mar. 5, 1957. 23p. Contract AT(49-6)-924. $0.35(OTS).

A solvent leaching process is described in which an organic solvent, consisting of 5 vol.% TBP and 95 vol.% kerosene, is sued to selectively leach uranium directly from nitrate-conditioned, acid-cured, low-grade ores. Filtration and other clarification operations common to most ore treatment processes are eliminated. The process has been tested on several Colorado Plateau ores, both primary and secondary, yielding over-all uranium recoveries ranging from 92 to 98%. A uranium product analyzing over 99% U_3O_8 is produced. (auth)

1906 Y-118(Del.)

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

PROGRESS REPORT ON SPECIAL PROJECTS FOR THE MONTH OF JANUARY 1948. G. H. Clewett. Feb. 10, 1948. Decl. with deletions Mar. 14, 1957. 15p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Uranium recovery from oil shale is discussed as to preparation and testing of shale, leaching experiments on raw and ignited ore at 80°C, leaching experiments at room temperature, specificity of $Al(NO_3)_3$ leaches and the washing necessary to recover $Al(NO_3)_3$ for recycle, chlorination prior to leaching, use of roasting agents prior to leaching and adsorptive properties of oil shales. Analytical development is reported on colorimetric determination of U shale and determination of U in sea water. (L.M.T.)

Transuranic Elements and Compounds

1907 LA-1079(Del.)

Los Alamos Scientific Lab., N. Mex.

QUANTITATIVE SEPARATION OF AMERICIUM AND PLUTONIUM USING CUPFERRON. J. P. Nigon and R. A. Penneman. Mar. 8, 1950. Decl. with deletions Feb. 7, 1957. 10p. Contract W-7405-Eng-36. $1.80(ph OTS); $1.80(mf OTS).

Americium and Pu are separated quantitatively by chloroform extraction of Pu cupferrate from HCl solution. This separation is successful from tracer concentrations up to gram quantities of Pu, and milligrams of Am. The separation is made routinely at two widely different Am/Pu ratios: (1) during Am purification where the Am/Pu ratio is of the order of 1/10; and (2) for Am assays on Pu solutions where the Am/Pu ratio varies from 10 to 250 ppm. For separation of macro-amounts, no carrier is needed. For small amounts, Fe and La are used, the former as a Pu carrier and the latter as a holdback for Am. Satisfactory plates for counting Pu can be made directly from aliquots of the chloroform extract of Pu cupferrate. (auth)

Uranium and Uranium Compounds

1908 A-3936(Del.)

Linde Air Products Co. Tonawanda Lab., Tonawanda, N. Y.

CONVERSION OF UF_6 TO URANIUM TRIOXIDE. Final Report May 3, 1946. Decl. Feb. 12, 1957. 137p. [For Carbide and Carbon Chemicals Corp. K-25 Plant]. Contract W-7405-eng-26, Subcontract No. 2. $25.80(ph OTS); $7.80(mf OTS).

The development of a process for conversion of UF_6 (containing about 30% U^{235}) to UO_3 is presented. The process consisted of hydrolysis with H_2O to UO_2F_2, evaporation, calcination in steam at 750°C, and oxidation from U_3O_8 to UO_3 by HNO_3 vapor at 350°C. The process for low U^{235} concentrations differs in that UO_4 is precipitated by H_2O_2 after the UO_2F_2 is treated with $Al_2(SO_4)_3$; the UO_4 is then calcined to UO_3. Pilot-plant designs and performance data are included. (T.R.H.)

1909 A-4003

Harshaw Chemical Co., Cleveland, Ohio.

THE MANUFACTURE OF URANIUM HEXAFLUORIDE. OPERATING MANUAL. G. C. Whitaker. Oct. 22, 1946. Decl. Mar. 11, 1957. 221p. $51.50(ph OTS); $11.10(mf OTS).

A manual is presented that explains the mechanics of plant operation and gives details of plant design for the preparation of UF_6 in commercial quantities. (W.L.H.)

1910 LA-1089

Los Alamos Scientific Lab., N. Mex.

A QUALITATIVE SURVEY OF THE PHYSICAL FACTORS AFFECTING THE PRECIPITATION OF URANIUM FROM URANYL NITRATE SOLUTION BY HYDROGEN PEROXIDE. B. L. Kelchner. July 7, 1950. Decl. Mar. 26, 1957. 62p. Contract W-7405-eng-36. $0.50(OTS).

The effects of pH, temperature, rate of addition of H_2O_2, uranium concentration in the starting solution, volume of the starting solution, excess H_2O_2, rate of stirring, and digestion time on the precipitation of uranium peroxide from a pure uranyl nitrate–water–nitric acid system in terms of filterability and settling rate of the precipitate, penetrability and bulk density of the resulting U_3O_8 obtained by calcination of the $UO_4 \cdot xH_2O$, and the concentration of uranium left in the filtrate are described. (auth)

1911 LA-1305

Los Alamos Scientific Lab., N. Mex.

ORALLOY CYLINDRICAL SHAPE FACTOR AND CRITICAL MASS MEASUREMENTS IN GRAPHITE, PARAFFIN, AND

WATER TAMPERS. E. C. Mallary. Oct. 27, 1951. Decl. Mar. 26, 1957. 24p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

Critical mass of an Oy (93.9%) sphere in graphite is given as a function of graphite tamper thickness. It was shown that ~20 in. of graphite is effectively infinite and that the ~17 in. used herein is ~98% infinite. Critical mass measurements of Oy (93.9%) spheres and cylinders of different diameters are given for ~17 in. graphite tamper, for effectively infinite paraffin tamper, and for effectively infinite water tamper. From these measurements cylindrical shape factors were computed. Both shape factors and critical masses are shown as functions of the critical height to diameter ratio of the cylinders. (auth)

1912 LA-1397

Los Alamos Scientific Lab., N. Mex.

THE PRESSURES AND TEMPERATURES DEVELOPED DURING THE REDUCTION OF URANIUM TETRAFLUORIDE BY THE BOMB METHOD. B. R. Hayward. Aug. 8, 1951. Decl. Mar. 26, 1957. 19p. Contract W-7405-eng-36. $0.30(OTS).

The pressure and temperature cycles developed during the bomb reduction of uranium tetrafluoride by calcium have been determined. Data for the 250, 500, and 1000 gram scale reductions are given, and the apparatus used is described. (auth)

1913 LA-1715

Los Alamos Scientific Lab., N. Mex.

THE INFLUENCE OF A PRECIPITATION HARDENING HEAT TREATMENT ON THE HARDNESS OF SEVERAL URANIUM–MOLYBDENUM ALLOYS. T. I. Jones, C. G. Hoffman, J. M. Taub, D. T. Doll, and F. M. Montoya. Aug. 1954. Decl. Mar. 26, 1957. 84p. Contract W-7405-eng-36. $13.80(ph OTS); $4.80(mf OTS).

Four uranium alloys containing nominally 0.5, 1.0, 1.5, and 2.0 wt. % molybdenum were investigated with respect to their response to hardening by heat treatment. The several alloys were heated at elevated temperatures to secure solid solution, then quenched and reheated at lower temperatures to obtain hardening. The procedure followed the well known industrial practice of solution treatment and precipitation hardening. The results showed that all the alloys could be hardened by a suitable heat treatment. No specific temperatures are recommended; however, within the limits of the investigation, a solution treatment at 850°C followed by a water quench and reheat at 450°C gave a considerable increase in hardness. The time at temperature to secure maximum hardness would need to be determined as a function of mass and section shape. It is presumed that other mechanical properties of the alloys would be influenced by heat treatment in a manner corresponding to the effect upon hardness. (auth)

1914 M-333(Pt. II)

Linde Air Products Co. Tonawanda Lab., Tonawanda, N. Y.

CONSTRUCTION, PROCESS, AND OPERATION REPORT. STEP I. Oct. 1, 1946. Decl. Mar. 5, 1957. 226p. Contract W-7401-Eng-14. $36.30(ph OTS); $10.20(mf OTS).

Directions are presented for the construction and operation of a plant for the production of 24,500 lb/wk of uranium oxide. Construction data include building specifications, building drawings, equipment specifications, and equipment reference drawings. Specifications and a list of vendors of equipment are included. A process is described for both the extraction of uranium from ore and the purification of liquors for the production of relatively pure U_3O_8. Seven different ores were used for the manufacture of the product. Flow sheets of the processes used in the extraction and purification of the three principal ores are included. Safety precautions and inventory methods are outlined. Ore and product handling methods and equipment are described. (C.H.)

1915 M-333(Pt. III)

Linde Air Products Co., Tonawanda Lab., Tonawanda, N. Y.

CONSTRUCTION, PROCESS, AND OPERATION REPORT. STEP II. Oct. 1, 1946. Decl. Mar. 8, 1957. 98p. Contract W-7401-ENG-14. $16.80(ph OTS); $5.70(mf OTS).

The process for producing purified UO_2 powder suitable for fluorination is described. The U_3O_8 feed is dissolved in HNO_3 and the $UO_2(NO_3)_2$ formed is extracted into ether, washed, and extracted with distilled water. Denitration to UO_3 is followed by H_2 reduction to UO_2. The plant and equipment specifications and the personnel requirements and operating procedure are given. (T.R.H.)

1916 M-2147

[Du Pont de Nemours (E. I.) & Co. Jackson Lab. Wilmington, Del.]

CHAMBERS WORKS PROCESS FOR THE MANUFACTURE OF CRUDE METALLIC URANIUM. George Firth. Jan. 13, 1945. Decl. Mar. 22, 1957. 10p. Contract [W-7412-eng-2]. $0.25(OTS).

Uranium tetrafluoride and Mg are reacted inside an insulating envelope of lime. The reaction is initiated by externally applied heat. Yields (~94%) were obtained. (auth)

1917 ORNL-611

Oak Ridge National Lab., Tenn.

THE COOLING OF IRRADIATED 25 MTR FUEL ASSEMBLIES AND ITS EFFECT ON 25 INVENTORY IN THE MTR PROJECT. H. E. Goeller. Mar. 15, 1950. Decl. Mar. 19, 1957. 33p. Contract W-7405-eng-26. $0.40(OTS).

The U^{235} consumption, U^{236} and U^{237} production, total and gaseous fission-product production, and shielding, based on La^{140} gamma emission were calculated for a 12-day MTR irradiation period at a power level of 30,000 kw for a loading of 3.2 kg of U^{235}. (auth)

1918 TID-5100

Battelle Memorial Inst., Columbus, Ohio.

RATIO OF VANADIUM TO URANIUM AS A FACTOR IN RECOVERING URANIUM FROM CARNOTITE ORES BY THE SALT-ROAST CARBONATE-LEACH PROCESS. D. D. Rabb, R. M. Stephens, Jr., and A. C. Richardson. Aug. 5, 1949. Decl. Feb. 4, 1957. 31p. Contract [W-38-094-eng-27]. $6.30(ph OTS); $3.00(mf OTS).

1919 WAPD-PMM-167

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

RÉSUMÉ OF URANIUM OXIDE—II. Z. M. Shapiro. June 30, 1955. Decl. Apr. 9, 1957. 92p.

This report is the combined UO_2 Resumes of all the participants in the UO_2 Panel. $0.60(OTS).

WAPD. Investigations were continued on the powder preparation, sintering, and fuel element fabrication of UO_2. The stability of UO_2 compacts in high-temperature water and the reaction of UO_2 slugs to thermal shock were studied. Magnetic susceptibility measurements indicate that UO_2 is characterized by a sharp antiferromagnetic transition at ~4°K. Thermal cycling effects, diffusion of fission products in, and reaction kinetics of UO_2 were also studied. Procedures are presented for the determination of U^{4+} and total U in solution. NBS. The effects on strength properties and bulk density of UO_2 samples, at various temperatures, of crystallite size and distribution, grain size and growth, and interstitial material were studied. Armour. The hot press and additive programs were con-

tinued. Battelle. Phase equilibria and reaction kinetics of the Zr–UO_2 systems were studied. The decomposition of uranyl nitrate hexahydrate yielded three polymorphic modifications of UO_3 and two oxide hydrates. The production of UO_2 using ceramic methods was investigated. KAPL. The effects of certain impurities on the sinterability of UO_2 powder were studied. Irradiation studies on UO_2 were continued. ORNL. The investigation of UO_2 included basic studies, fabrication methods, production of various grain sizes, physical property measurements, and radiation effects. Physical properties are tabulated for ThO_2 and UO_2. (C.W.H.)

1920 WAPD-PWR-PMM-429(Del.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RÉSUME OF URANIUM OXIDE DATA. V. J. Belle. Mar. 6, 1956. Decl. with deletions Mar. 14, 1957. 72p. Contract AT-11-1-GEN-14. $0.45(OTS).

Brief reports of experimental work on preparation and properties of UO_2, radiation effects on UO_2 and fabrication of UO_2 at WAPD, BMI, Corning, and MCW are given. Data are given on surface area and density of UO_2 from various preparations, sintered density of UO_2 as affected by particle size, oxygen to uranium ratio, and sintering time, properties of sintered UO_2, oxidation kinetics of UO_2, and oxidation of Zircaloy-2. (T.R.H.)

1921 WAPD-PWR-PMM-466(Del.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RÉSUMÉ OF URANIUM OXIDE DATA—VI. J. Belle and L. J. Jones. June 5, 1956. Decl. Mar. 12, 1957. 78p. Contract AT-11-1-GEN-14. $0.45(OTS).

A survey is made of developments in preparation, properties, fabrication, sintering, and cladding of uranium oxides and radiation effects on uranium oxides. (T.R.H.)

1922 WAPD-PWR-PMM-496(Del.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MINUTES OF URANIUM OXIDE PANEL MEETING. R. E. Cowan. Sept. 28, 1956. Decl. with deletions Mar. 12, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

The various subjects discussed were: irradiation of UO_2–stainless steel dispersion type fuel elements; release of fission gases from UO_2 and their effects on annular pin type fuel elements; emanation of fission gases from UO_2; failure of an undefected PWR reference fuel rod in the X-1-h loop test at Chalk River; fabrication of UO_2 rods by the flame fusion process; results on the micronizing process for the preparation of readily sinterable UO_2; and the effect of steam on the sintering of UO_2. (W.L.H.)

Waste Disposal

1923 WAPD-T-387
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
A DISCUSSION OF THE RADIOACTIVE WASTE DISPOSAL FACILITIES AT THE SHIPPINGPORT ATOMIC POWER STATION. [1956]. 8p. $1.80(ph OTS); $1.80(mf OTS).

ENGINEERING

1924 CF-56-3-16
Oak Ridge National Lab., Tenn.
OPERATION OF IN-PILE LOOP L-4-5 (EE). F. J. Walter. Mar. 2, 1956. Decl. Feb. 8, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Operation of in-pile loop L-4-5 was terminated by failure of the circulating pump. When this failure occurred the automatic instrument control circuits performed satisfactorily. The loop was drained and removed without difficulty. A small amount of water was found in the loop connector. There were no thermocouple failures on this loop. Oxygen additions were made with the loop at full operating temperature and pressure. The loop and pressurizer heater wattmeters were calibrated. A constant voltage transformer was installed in the soup weigh tank measuring system. (auth)

1925 KAPL-M-FGH-2
Knolls Atomic Power Lab., Schenectady, N. Y.
EVALUATION OF MERCURY VAPOR REMOVAL METHODS FOR CONFINED COMPARTMENTS. F. G. Haag. Feb. 1, 1956. 7p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

The activated charcoal adsorption process for removal of Hg vapor from habitable compartments of the "Seawolf" submarine was considered impractical. (T.R.H.)

1926 R-50GL231
General Electric Co. General Engineering and Consulting Lab., Schenectady, N. Y.
INVESTIGATION OF LIQUID METAL LUBRICATED BEARINGS. Harry Apkarian. Nov. 27, 1950. Decl. Mar. 19, 1957. 10p. $6.30(ph OTS); $3.00(mf OTS).

The liquid metal lubricated bearing program was an investigation to determine (1) the feasibility of using liquid metals as bearing lubricants, (2) characteristics and behavior of bearings with liquid metal lubricants, and (3) design criteria for liquid metal lubricated bearings. The liquid metal lubricant used was a mixture of 50% Na and 50% K by weight. It was determined that liquid metals, such as NaK, when used as lubricants behave in accordance with established hydrodynamic principles in much the same manner as any conventional lubricant. Properly designed bearings lubricated by liquid metal will support practical loads through a wide range of temperature and speed. (auth)

1927 WAPD-PM-37
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SUMMARY OF WAPD-1 SERIES EXPERIMENTS. F. Gaidos. Dec. 1955. 9p. $1.80(ph OTS); $1.80(mf OTS).

A thimble was installed in the Materials Testing Reactor for running creep tests on Zr. The instrumentation of this thimble, pre-test experiments, and the test results are described. (D.E.B.)

1928 WAPD-T-39
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
DIRECT LINEAR MOTION IN SEALED SYSTEMS. R. C. Robinson and W. E. McCown. [1953]. 15p. $3.30(ph OTS); $2.40(mf OTS).

A linear motor and control system is described. It exceeded design requirements of a linear travel of 6 inches, net force of 100 pounds, and maximum velocity of 1 ft/sec. These requirements had to be met with the rotor immersed in fluid at 2,000 psi and with a canned stator. The motor operated more than the required 100,000 cycles at full amplitude and full speed under the required conditions. (T.R.H.)

1929 WAPD-T-40
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
POSITION CONTROL IN SEALED SYSTEMS. W. H. Esselman and W. H. Hamilton. [1953]. 22p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

Methods developed for producing short and long translational motion and low and high speed rotational motion in sealed reactor systems are described. Typical canned

motors and solenoids used in such applications are shown. (D.E.B.)

Heat Transfer and Fluid Flow

1930 CF-53-8-106
Oak Ridge National Lab., Tenn.
PRELIMINARY RESULTS ON FLINAK HEAT TRANSFER. H. W. Hoffman. Aug. 18, 1953. Decl. Feb. 20, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Heat transfer coefficients have been measured for flinak flowing turbulently in both Ni and inconel tubes. The data obtained using the Ni tube lie in the hydrodynamic transition region and substantially check the heat transfer correlation for most ordinary fluids. The inconel tube data fall considerably below the expected correlation. It is believed that this discrepancy is due to a film formed on the surface of inconel in the presence of flinak. The existence of this film has been demonstrated and its composition partially determined. (auth)

1931 KAPL-M-JLN-2
Knolls Atomic Power Lab., Schenectady, N. Y.
USE OF "TELEDELTOS" PAPER TO SOLVE HEAT CONDUCTION PROBLEMS BY ELECTRICAL ANALOGY. J. L. Noble. June 13, 1956. 10p. Contract W-31-109-eng-52.

1932 R49GL82
General Electric Co. General Engineering and Consulting Lab., Schenectady, N. Y.
PREDICTED PART LOAD HEAT TRANSFER PERFORMANCE OF THE "GENIE" SMALL TEST SYSTEM. T. Trocki, H. A. Johnson, and T. W. Hunt. Sept. 6, 1949. Decl. Mar. 16, 1957. 179p. $28.80(ph OTS); $8.40(mf OTS).

The part load performance calculation of a system for which all geometrical data are known is described in detail. The method of control maintains constant sodium temperatures in and out of the intermediate heat exchanger and constant steam conditions leaving the steam generator. The geometrical data and evaluation of corresponding over-all heat transfer coefficients U, which are characteristic of the individual system components, are given. (auth)

1933 TID-278(Del.)
Technical Information Service, AEC.
HEAT TRANSFER. Reports from Session XII, General Information Meeting, October 24, 25, 26, 1949, Oak Ridge, Tennessee. Decl. with deletions Feb. 28, 1957. 53p. $9.30(ph OTS); $3.60(mf OTS).

Papers are presented on heat transfer with boiling, heat transfer to liquid metals, transient heat transfer effects resulting from supercriticality, heat transfer coefficients for Bi alloys, and heat transfer and pressure drop through graphite ball columns. (L.T.W.)

1934 WAPD-AD(T)-1095
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
MECHANICAL DESIGN OF HEAT EXCHANGERS. Aug. 1954. 102p. $16.80(ph OTS); $5.70(mf OTS).

Design data and a design method are presented in a logical sequence so that a standardized method of heat exchanger mechanical design is available in a complete entity requiring minimum recourse to additional reference. Data are organized such that the design will be completed in a logical manner that lends itself to easy checking. Data and drawings were taken from the American Society of Mechanical Engineer Code, Standards of the Tubular Exchanger Manufacturers Association, and experience of the Thermal Design Section, Westinghouse Atomic Power Division. Special design for the United States Navy is covered in a separate section. (D.E.B.)

1935 WAPD-ARS(A-2)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SURVEY OF HIGH CAPACITY STEAM GENERATOR DESIGN. R. E. Bruckner. Oct. 11, 1954. 33p. $6.30 (ph OTS); $3.00(mf OTS).

The results of a survey of world literature on high capacity steam generator design are reported. Salient features of molten metal steam generators as well as hot plates for heating surfaces are included. (D.E.B.)

1936 WAPD-LSR(IM)-1
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
AN INVESTIGATION OF SUBCOOLED AND QUALITY BURNOUT IN CIRCULAR CHANNELS. T. W. Hunt, H. S. Jacket, J. D. Roarty, and J. E. Zerbe. Jan. 26, 1955. Decl. Sept. 17, 1957. 45p. Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30(mf OTS).

Burnout heat flux data under conditions of local boiling and bulk boiling at the circular channel exit were obtained with the Bettis Burnout Loop. Subcooled burnout tests were run at 2000 psia. Quality burnout data were obtained for 1000 and 2000 psia. The effect of inclining a channel at an angle of 45° was also investigated. Quality burnout data are reported in graphical and tabular form. No correlation is suggested from the limited tests run that will predict burnout from local conditions when bulk boiling occurs. A description of the Bettis Burnout Loop and method of operation are discussed. The application of quality burnout data to reactor core design is discussed briefly. (auth)

1937 WAPD-T-215
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PREDICTION OF LOCAL AND AVERAGE HEAT TRANSFER COEFFICIENTS BY MASS TRANSFER TECHNIQUE FOR PARALLEL FLOW OVER INTERRUPTED FLAT PLATES (thesis). James I. Spiegel. 1956. 94p. $15.30 (ph OTS); $5.40(mf OTS).

Submitted to the Univ. of Pittsburgh.

Average and local heat transfer coefficients for parallel air flow over interrupted flat plates are determined by utilizing the mass transfer analogy to heat transfer. A seldom used technique (an air–naphthalene system) is used to obtain the experimental transfer data. Results are expressed in the form of curves of the average Nusselt number vs. Reynolds number and of naphthalene removed over the plate surface (local coefficients) against distance from the leading edge for each Reynolds number. (L.M.T.)

1938 WAPD-T-310
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
STEADY STATE THERMAL STRESS DISTRIBUTION IN LONG HOLLOW CYLINDERS EXPERIENCING A RADIAL EXPONENTIAL INTERNAL HEAT GENERATION (thesis). Harry J. Honohan. 1956. 68p. $12.30(ph OTS); $4.50 (mf OTS).

Submitted for publication to the Univ. of Pittsburgh.

1939 WAPD-T-319
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
INVESTIGATION OF BURNOUT HEAT FLUX IN RECTANGULAR CHANNELS AT 2000 PSIA. H. S. Jacket, J. D. Roarty, and J. E. Zerbe. June 1956. 29p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

Burnout heat flux data were obtained under conditions of zero exit quality and bulk boiling at the exit of electrically

heated test specimens. These specimens were long, narrow channels with various slot thicknesses, surfaces, materials, and length-to-diameter ratios. Tests were run at 2000 psia and mass velocities from $\sim 0.2 \times 10^6$ to 3×10^6 lb/hr-ft^2. The effect of inclining the channel at 45° was also investigated. The rectangular channel burnout results are in reasonable agreement with data previously obtained for round tubes. A design equation is suggested which yields a conservative estimate of the burnout heat flux in the low subcooling and quality regions. A burnout loop and method of operation are described. (auth)

Materials Testing

1940 HW-14764(Del.)
Hanford Works, Richland, Wash.
SPECIAL IRRADIATION OF TEMPERATURE-INDICATING LIQUID. Final Report — Production Test 105-266-P. M. W. Carbon. Aug. 18, 1949. Decl. with deletions Mar. 12, 1957. 2p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A sample of "Tempilaq," a commercially available temperature-indicating liquid, was irradiated for 21 days. It was then placed in an electric furnace and was found to melt at its designated melting point. Results of the test indicate that the substance may be used in measuring certain temperatures within the pile. (C.H.)

1941 KAPL-M-EDL-5
Knolls Atomic Power Lab., Schenectady, N. Y.
EXPERIMENTAL STRESS TEST OF BEAM WITH UNIFORM HOLE PATTERN. C. C. Ripley. May 1, 1952. 9p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The stress distribution and magnitude resulting from bending a duralumin bar simulating the SIR orifice plate were investigated. (T.R.H.)

1942 KAPL-M-EDL-13
Knolls Atomic Power Lab., Schenectady, N. Y.
LIFE TEST OF HIGH SPEED TOOL STEEL NEEDLE BEARINGS. Test No. 6. D. B. Vail and J. E. Robinson, Jr. Apr. 1, 1953. 14p. Contract W-3[1]-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The needle bearings tested performed satisfactorily in liquid sodium at 850°F under 200 lb. load. (T.R.H.)

1943 KAPL-M-EDL-23
Knolls Atomic Power Lab., Schenectady, N. Y.
HIGH TEMPERATURE TESTS OF STANDARD NEEDLE BEARINGS. A. W. Bedford, Jr., and D. B. Vail. Dec. 18, 1952. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Standard needle bearings were tested dry and with NaK lubrication at 800°F with an oscillating motion up to 5° and found satisfactory. (T.R.H.)

1944 KAPL-M-EDL-24
Knolls Atomic Power Lab., Schenectady, N. Y.
LIQUID METAL BEARING TESTER. D. B. Vail. Feb. 1, 1954. 10p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A liquid metal bearing testing apparatus for development of bearings for SIR is described. (T.R.H.)

1945 KAPL-M-EDL-49
Knolls Atomic Power Lab., Schenectady, N. Y.
CONTROL CYLINDER DIRT TEST. R. H. Stokes. July 22, 1953. Decl. Apr. 25, 1957. 6p. Contract W-3[1]-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Tests were conducted to determine the effects of foreign particles on control cylinder operation. Particles larger than $\frac{1}{32}$ in. caused the cylinder to jam. (D.E.B.)

1946 KAPL-M-RCD-22
Knolls Atomic Power Lab., Schenectady, N. Y.
TESTING OF ALLOY FUEL ELEMENTS. Interim Report. William R. Plant. June 1, 1954. Decl. Mar. 28, 1957. 8p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80 (mf OTS).

Four types of tests were applied in testing fuel elements; x-ray, ultrasonic transmission, ultrasonic shear, and the frost test. These tests are described and their applicability discussed. Results obtained on a number of elements are tabulated. (D.E.B.)

1947 WAPD-A1W(RD)-526
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
RING SPRING TESTS. W. W. Wise, B. R. Teer, N. R. Wheelock, J. W. Flaherty, J. J. Lescisin, and J. V. Marron. May 18, 1956. 69p. Contract [AT-11-1-GEN-14]. $12.30 (ph OTS); $4.50(mf OTS).

Tests were made primarily to determine the suitability of ring springs for thermally actuated cluster clamping devices and for core clamping devices. The tests and studies include a comparison of theoretical and experimentally measured clamping movement, determination of various effects on the coefficient of friction, and the resistance to corrosion of various materials subjected to oxygenated water at elevated temperature. (auth)

1948 WAPD-FE-893
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PRELIMINARY EVALUATION OF HELICAL GROOVES AS CRACK ARRESTERS. L. F. Cochrun. July 12, 1955. Decl. Mar. 19, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

An evaluation of helical grooves as crack arresters in seamless Zircaloy-2 tubing was made. (T.R.H.)

1949 WAPD-FE-1004
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EFFECT OF WALL THICKNESS TOLERANCE ON SOME PROPERTIES AND FAILURE CHARACTERISTICS OF REFERENCE SIZE ZIRCALOY-2 TUBING. L. F. Cochrun. Sept. 19, 1955. Decl. Apr. 15, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

Waste Disposal

1950 WAPD-T-419
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
ESTIMATION OF RADIOACTIVITY AT A POWER REACTOR; ITS TREATMENT AND CONTROL. J. R. LaPointe. [1956]. 12p. $3.30(ph OTS); $2.40(mf OTS).

The disposal of radioactive materials from the Shippingport Pressurized Water Reactor site is discussed. Coolant radioactivity, spent demineralizer resin, combustible contaminated paper, rags and clothing, and incombustibles such as tools, metal turnings, and small equipment will be disposed of by concentration and storage, and burial. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

1951 BMI-T-13
Battelle Memorial Inst., Columbus, Ohio.
FABRICATION OF BERYLLIA SHAPES BY CERAMIC EX-

TRUSION. H. Z. Schofield, W. H. Duckworth, and R. E. Long. May 1, 1949. Decl. Feb. 13, 1957. 24p. Contract W-7405-eng-92. $0.30(OTS).

The results of studies of fabrication methods and techniques for obtaining shapes of porous beryllia which could be impregnated with fissionable material for pile use are presented. Extrusion of multi-hole shapes was accomplished through the use of a pre-gelatinized corn starch plasticizer and special steel die designs. Extrusions were sintered for three hours at 3100°F. (D.E.B.)

1952 M-4518
Norton Co., Worchester, Mass.
PRODUCTION OF FUSED MAGNESIA REFRACTORIES. C. H. Gustafson, Jr. and O. J. Whittemore, Jr. Nov. 10, 1950. Decl. Mar. 20, 1957. 6p. $3.30(ph OTS); $2.40(mf OTS).

Users of fused magnesia refractories may obtain from this brief report an illustration of the various shapes now being manufactured and other products which could be made with additional equipment. The progress made since 1946 in purity of raw materials, shapes, compositions, and control of manufacture is shown. (F.S.)

Corrosion

1953 AECD-3733
California Research Corp. San Pablo, Calif.
DYNAMIC CORROSION AND MASS TRANSFER OF CHROME STEEL BY BISMUTH. C. J. Egan. Dec. 14, 1951. 16p. $4.80(ph OTS); $2.70(mf OTS).

Experimental data obtained on the corrosion of 5% Cr–0.5% Mo steel by liquid Bi under conditions permitting mass transfer to occur are summarized. (L.T.W.)

1954 CF-54-3-196
Oak Ridge National Lab., Tenn.
PROPOSED IN-PILE LOOP EXPERIMENT. G. H. Jenks, D. T. Jones, J. N. Baird, and J. L. Redford. Mar. 31, 1954. Decl. Apr. 1, 1957. 35p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A test system was devised for the study of radiation effects on corrosion in a homogeneous reactor system. Basically, the system consists of a small loop through which fuel solutions are circulated by a small centrifugal pump. Discussions are given on loop operating characteristics and design, insertion and removal procedures, and hazards. (B.J.H.)

1955 HW-18595
Hanford Works, Richland, Wash.
CORROSION OF REDOX WASTE STORAGE TANK CONSTRUCTION MATERIALS. W. W. Koenig and K. L. Sanborn. Aug. 21, 1950. Decl. Apr. 11, 1957. 43p. Contract W-31-109-eng-52. $7.80(ph OTS); $3.30(mf OTS).

Austenitic stainless steel showed excellent corrosion resistance to the IAW Redox Stream (synthetic) at pH = 0, 2, and 10 and should equal or better its performance in the present separations process. The resistance of the mild steel was primarily a function of the pH of the waste streams. Best results were obtained at pH>9.5. None of the protective coatings gave completely satisfactory results under all of the test conditions which were employed. (auth)

1956 KAPL-M-FDL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE ANALYSIS OF ZIRCALOY II CORRODED BY DIPHENYL. F. D. Leipziger, comp. May 31, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The results from analyses of Zircaloy-2 exposed to diphenyl at 500°, 680°, and 750°F for periods up to 4700 hours are given and discussed. (T.R.H.)

1957 KAPL-M-GEG-6
Knolls Atomic Power Lab., Schenectady, N. Y.
CORROSION OF METALLIC MATERIALS IN PILE-IRRADIATED HIGH TEMPERATURE WATER. 2. SUMMARY OF TESTS IN PROGRESS AND PLANNED. G. E. Galonian. May 29, 1956. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

1958 WAPD-A1W(M)-71
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
SECOND INTERIM REPORT ON THE CORROSION BEHAVIOR OF ZIRCALOY-3. Stanley Kass. Mar. 8, 1956. 21p. $4.80(ph OTS); $2.70(mf OTS).

At the present state of testing Zircaloy-3A continues to show better corrosion properties than do the 3B and 3C compositions. In the 750°F steam test Zircaloy-3A is superior to Zircaloy-2 in that the past-transition rate is lower by about 20%. Indications based on results from transfer experiments are that a similar favorable ratio of past-transition corrosion rates exist at 680 and 600°F. In the pre-transition region Zircaloy-2 and Zircaloy-3A, B, and C are indistinguishable. (auth)

1959 WAPD-C-129
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CRUD MEMORANDUM NO. 18. (Contains information through March 23, 1953.) D[onald] M. Wroughton. Mar. 30, 1953. Decl. Feb. 21, 1957. 21p. $4.80(ph OTS); $2.70(mf OTS).

1960 WAPD-C-137
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CRUD MEMORANDUM NO. 20. (Contains information through April 20, 1955.) D[onald] M. Wroughton. Apr. 23, 1953. Decl. Feb. 21, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

1961 WAPD-C-141
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CRUD MEMORANDUM NO. 21. (Contains Information through May 4, 1953). D[onald] M. Wroughton. May 7, 1953. Decl. Feb. 21, 1957. 22p. $4.80(ph OTS); $2.70 (mf OTS).

Aqueous corrosion rates of stainless steels, zirconium, Zircaloy-2, Inconel, Cu–Ni alloy, Stellite, Monel, steels, Hf, and Ni alloys are given. The effects of H_2 and O_2 in the circulating water were studied. (T.R.H.)

1962 WAPD-MDM-24
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CORROSION OF ZIRCONIUM–URANIUM ALLOYS. D. E. Thomas. Dec. 29, 1954. Decl. Mar. 21, 1957. 22p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

The following tentative conclusions relating to the corrosion behavior of crystal bar base U–Zr alloys are given: (1) The 10 and 20 wt. % U alloys exhibit weight gains when exposed to 600°F water provided the alloys are previously β-quenched; (2) The alloys containing 30 to 60 wt. % U exhibit weight losses when exposed to 600°F water, the corrosion rate increasing with increasing U content. Discontinuous failure occurs presumably when untransformed β phase is present in the microstructure. Highly variable results are obtained with the 60 wt. % U alloy. (3) The corrosion rate of the 50 wt. % U alloy having optimum heat treatment is approximately equal to that of

the γ-phase U–12 wt. % Mo alloy, but the 50 wt. % U alloy does not exhibit early discontinuous failure. (4) Further work is required to establish these tentative conclusions and to establish the effect of the use of sponge Zr as melting stock. (auth)

1963 WAPD-MM-200(Del.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REPORT OF THE MARCH 1953 MEETING OF THE ZIRCONIUM ALLOY CORROSION COMMITTEE. K. M. Goldman. Mar. 24, 1953. Decl. with deletions Mar. 5, 1957. 68p. $10.80(ph OTS); $3.90(mf OTS).

The results of work done on the corrosion of Zircaloy-2 and other alloys are presented. Zircaloy-2 shows excellent corrosion resistance to steam at 750°F and water at 680°F for periods up to three and four months, respectively. There is little or no effect of Sn content on the corrosion resistance of sponge-base alloys of Zr containing 0.12% Fe, 0.10% Cr, and 0.05% Ni tested for 45 days at 750°F and 28 days at 680°F. This suggests lowering the Sn content in Zircaloy-2 to obtain increased fabricability with no sacrifice in corrosion resistance. Enough Sn should remain to insure a good N_2 tolerance. Although relative effectiveness of Fe, Ni, and Cr in Zircaloy-2 has not yet been determined, it appears that low totals of Fe, Ni, and Cr are detrimental to corrosion resistance. Some samples of unalloyed Zr sponge displayed excellent corrosion resistance to 680°F water for 14 days and 750°F steam for 48 hours. (W.L.H.)

1964 WAPD-RM-17
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EFFECT OF NITROGEN AND CARBON ON THE CORROSION OF ZIRCONIUM IN 600°F WATER. B. Lustman. July 26, 1950. Decl. Dec. 8, 1955. 16p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

It is concluded that C and N_2 are both detrimental to the corrosion resistance of Zr; in both cases the corrosion resistance of Zr is continuously and more severely impaired the greater the amount of each contaminant added. (auth)

1965 WAPD-RM-40
Westinghouse Atomic Power Div.
THE CORROSION RESISTANCE AND TENSILE PROPERTIES OF ZIRCONIUM–TANTALUM ALLOYS. C. R. Simcoe, E. S. Wright, and D. E. Thomas. Feb. 16, 1951. Decl. Mar. 20, 1957. 15p. Contract AT-11-1-GEN-14. $0.50(OTS).

1966 WAPD-T-403
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE CORROSION MECHANISM OF URANIUM-BASE ALLOYS IN HIGH TEMPERATURE WATER. M. W. Burkart and B. Lustman. Aug. 1956. 19p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Gamma phase uranium alloys containing 3 to 12 wt. % Mo were corrosion-tested in high-temperature water in order to formulate a general scheme for the corrosion of gamma-phase uranium alloys. (L.T.W.)

Metals and Metallurgy

1967 ANL-4003(Del.)
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION REPORT FOR APRIL, MAY, AND JUNE 1947. June 30, 1947. Decl. with deletions Feb. 12, 1957. 27p. Contract W-31-109-eng-38. $4.80 (ph OTS); $2.70(mf OTS).

Progress is reported in the following studies: the casting and fabrication of Co; the rolling of as-cast Th; the physical properties and corrosive effects of liquid NaK on a number of metals; the diffusion of U with several solid metals; the fabrication of a flash boiler for use in a NaK to water heat exchanger; the canning of uranium bricks; the electrodeposition of pure Fe foil; and the metallography of Be. (C.H.)

1968 ANL-5153(Del.)
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION QUARTERLY REPORT [FOR] JULY, AUGUST, AND SEPTEMBER 1953. Sept. 30, 1953. Decl. with deletions Feb. 13, 1957. 61p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

Progress is reported in the extrusion of Cu-clad Zr billets into tubing, welding of Zr strip into tubing using a Yoder resistance welding tube mill, piercing of Zr billets into a base tube, the casting and fabrication of U–Nb alloys, the rolling of Zircaloy sheet, the roll-cladding of Zircaloy to U–Nb alloys, the fabrication of plate type reactor fuel elements of U–Nb alloys roll bonded with Zircaloy, fabrication of a complete U^{235}–Zr fuel slug for the EBR, the fabrication of U–Zr alloy rod into EBR fuel blanket slugs, the thermal cycling of U–Zr rods following heat treatment, the fabrication of enriched U reactor fuses, the preparation and dimensional stability of U single crystals, twinning in U crystals, diffusion in Cu–U couples, the fabrication of U billets from electrolytic crystals, the preparation of U–Zr and Nb–U alloys, effects of radiation on U, the effects of radiation on U–Zr alloys, the corrosion of Al, Zr, and Nb–U alloys, and the effects of heat treatments on Nb–U alloys. (C.H.)

1969 ANL-5209
Argonne National Lab., Lemont, Ill.
FABRICATION AND PROPERTIES OF EXTRUDED SILVER–CADMIUM CONTROL RODS. Austin E. Dwight. Jan. 1954. Decl. Feb. 20, 1957. 33p. Contract W-31-109-eng-38. $6.30(ph OTS); $3.00(mf OTS).

The production of cross-type control rods having a span of 4-⅞ in., and an arm thickness of ⅛ in., was studied. Extrusion techniques were developed for producing cross-type control rods from each of two alloys; one containing 75% silver-25% cadmium, and the other containing 67% silver-30% cadmium-3% copper. Fabrication of the extruded crosses into clad control rods for the Mark I naval reactor was attempted. A set of unclad control rods for the Zero Power Reactor was produced. The effect of copper, nickel, aluminum, palladium, and indium, singly and in various combinations, on the physical and mechanical properties of silver-cadmium was studied. Data are given on the work hardening and annealing of binary silver-cadmium alloys, and on the precipitation hardening of certain complex silver-cadmium alloys. A materials specification and suggested fabrication procedure were established for nickel-clad extruded silver-cadmium control rods. (auth)

1970 BMI-701(Del.)
Battelle Memorial Inst., Columbus, Ohio.
THE FABRICATION AND COMPATIBILITY OF METALLIC FUEL ELEMENTS FOR HIGH-TEMPERATURE SERVICE. H. A. Saller and J. T. Stacy. Oct. 8, 1951. Decl. with deletions 1957. 42p. Contract W-7405-eng-92. $7.80 (ph OTS); $3.30(mf OTS).

This report covers an experimental investigation into the fabrication of various potential fuel-element materials and the testing of these materials for compatibility with structural metals at 1090°C (2000°F). The fabrication of fuel-element materials containing dispersions of UO_2, UC_2, or uranium–beryllium compound in matrices of molybde-

num, beryllium, or Type 316 stainless steel was surveyed using powder-metallurgy methods. Four of these materials were found to be quite amenable to sintering and rolling in jackets, i.e., UO_2 in beryllium, in stainless steel, or in molybdenum, and uranium–beryllium compound in beryllium. A fifth material, UO_2 in nickel, appeared promising but was not thoroughly investigated. Compatibility tests were carried out in vacuo for 100 hours at 1090°C plus 15 thermal cycles between room temperature and 1090°C. The structural metals used in these tests were beryllium, molybdenum, and stainless steel (Type 316). Beryllium reacted strongly with molybdenum-, stainless steel-, and nickel-base composites. Molybdenum behaved similarly with beryllium-base composites low in UO_2 or uranium–beryllium compound but with increasing amounts of these uranium-bearing compounds the reaction decreased markedly. UO_2 in molybdenum- or stainless steel-base composites was nonreactive. (auth)

1971 BMI-863(Rev.)
Battelle Memorial Inst., Columbus, Ohio.
DIFFERENTIAL THERMAL-EXPANSION EFFECTS ON BRAZED JOINTS. H. A. Saller, E. M. Baroody, H. W. Deem, J. T. Stacy, and H. L. Klebanow. Sept. 4, 1953. Decl. Mar. 9, 1957. 21p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

Differential thermal-expansion effects in brazed joints involving Type 310 stainless steel and GE-62 brazing alloy were investigated. The work included dilation and modulus-of-elasticity measurements using homogeneous cast specimens and observations on bimetallic cantilevers made of the two constituents. No anomalies were found, although there were irregularities in the expansion of the brazing alloy which were ascribed to a solubility phenomenon. The elastic modulus of the brazing alloy was determined. Cantilever deflections with temperature and with load were measured, and the results were interpreted using equations which treat the specimens as true bimetals consisting of two homogeneous components. The difference in thermal-expansion coefficients obtained in this way from the temperature-deflection data was consistent with the dilation measurements. The load measurements yielded an average elastic modulus for the bimetal which was about two-thirds of what would have been expected from knowledge of the components. This discrepancy probably arose from porosity which was observed in the braze component. (auth)

1972 BMI-956
Battelle Memorial Inst., Columbus, Ohio.
THE TENSILE STRENGTH OF SOLID-STATE BONDED ALUMINUM AND NICKEL-PLATED URANIUM. H. A. Saller, R. F. Dickerson and R. J. Carlson. Oct. 21, 1954. Decl. Feb. 13, 1957. 24p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

To aid in the evaluation of solid-state bonding techniques for cladding natural-uranium fuel-element cores with aluminum, tensile specimens, $\frac{1}{4}$ in. in diameter and 3 in. long were made and tested. Results show that these techniques are capable of producing satisfactory bonds between aluminum and nickel-plated uranium. Pressing conditions of 1 min at 950°F and 6000 psi produced consistent bond strengths equal to the yield strength of 2S aluminum. When optimum bonding conditions are used, anodic activation and strike-current density are not critical to bond strength. Nickel plating of the aluminum component of the bond couple reduced the tensile strength by about 50%. (auth)

1973 BMI-1034
Battelle Memorial Inst., Columbus, Ohio.
ENAMELS FOR THE PROTECTION OF ALUMINUM CANS FOR URANIUM SLUGS. John Schultz, Harlan P. Tripp, Burnham W. King, and Winston H. Duckworth. Aug. 31, 1955. Decl. Feb. 12, 1957. 22p. Contract W-7405-eng-92. $0.30(OTS).

Enamels for 2S Al were developed which exhibited corrosion rates of about $\frac{1}{15}$ that of bare Al when exposed to boiling alkaline water for 100 hr. These enamels were based on the Na_2O-PbO-SiO_2 eutectic composition with substitutions of a total of 10 to 15 w/o of TiO_2, ZrO_2, and alkaline earth oxides for PbO and Na_2O. About 1 w/o NiO was beneficial for promoting adherence. Enamels having the lowest corrosion rates all contained small amounts of Li_2O. Best results were obtained when 2S Al was used as the base metal for enameling. Other Al alloys, EC metal and 63S, also enameled satisfactorily. However, 24S alloy did not survive the firing operation necessary to fuse the enamel to the metal. The presence of pinholes and fractures in the enamel resulted in pitting of the exposed Al at rates two to three times greater than that of completely bare Al under the same conditions. Therefore, defect-free enameling would be required to obtain suitable protection. (auth)

1974 BMI-1076(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING FEBRUARY, 1956. Russell W. Dayton and Clyde R. Tipton, Jr. Mar. 1, 1956. Decl. with deletions Feb. 13, 1957. 79p. Contract W-7405-eng-92. $12.30(ph OTS); $4.50(mf OTS).

Developmental research on reactor materials is reported. Among the materials considered are U alloys, Sn–Zr alloys, Zr, graphite, UO_2, and Ti. Corrosion and metallurgical properties and fabrication techniques are included. (D.E.B.)

1975 BMI-HRN-8(Del.)
Battelle Memorial Inst., Columbus, Ohio.
MEMO ON WORK AT BATTELLE DURING MAY 1947. H. R. Nelson. May 31, 1957. Decl. with deletions Feb. 13, 1957. 20p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

Iron-bearing concretes having bulk densities as high as 5.4 gms/cc with adequate strengths and pouring properties were prepared. Effects of sizes of iron aggregate on strength, density, and pouring properties have been determined. A 1000-hour creep test of beryllium at 1700°F and loaded at 28.7 psi gave a final rate of 0.000055% per hour and a total elongation of 0.74%. Aluminum brazing, copper brazing, and self-welding all appear possible and even promising methods of joining beryllium. Several thorium ingots were forged, rolled, and machined into Hanford slugs. Forging and hot rolling is a very satisfactory fabrication process for thorium. Studies of the bonding of uranium rods in nickel tubes were started. (auth)

1976 BMI-T-6
Battelle Memorial Inst., Columbus, Ohio.
THE BONDING OF URANIUM TO NICKEL. H. A. Saller and J. R. Keeler. Feb. 1, 1949. Decl. Feb. 13, 1957. 26p. Contract W-7405-eng-92. $0.35(OTS).

A method of metallurgically bonding U inside Ni tubes was developed for use in jacketing the fuel rods in the Argonne Fast Neutron Pile. The bond was obtained by Ag plating the surfaces to be joined and diffusion bonding the mating Ag surfaces with the aid of an amalgamating agent such as Hg. Silver was found to be an excellent barrier between Ni and U at temperatures up to 600°C. Heating for 150 hr at 600°C caused practically no change in the bond, and only slight diffusion occurred in 125 hr at 700°C. The bond was homogeneous, having no cracks or voids, and withstood 60 cycles between 100°C and 550°C without failure. Indium could be substituted for Hg as an amalgam-

ating agent, but Sn was unsatisfactory because it formed brittle compound layers with U on extended heating. Molten solders were investigated for joining U to Ni, but in all cases were unsatisfactory because circumferential cracking occurred in the bond when the joints cooled to room temperature. (auth)

1977 BMI-T-16
Battelle Memorial Inst., Columbus, Ohio.
CONTROL OF PARTICLE SIZE IN ALUMINUM–URANIUM ALLOYS. H. A. Saller, J. R. Keeler, and N. S. Eddy. Nov. 15, 1949. Decl. Feb. 13, 1957. 19p. Contract W-7405-eng-92. $0.15.

The factors affecting the size of the Al–U compound particles in alloys containing a nominal 40% U were investigated. The size of the compound particles decreased as the pouring temperature was increased from 1040 to 1290°C. The thickness of the casting also had a marked effect on the size of the compound, particularly at low pouring temperatures. By combining these two effects, it was possible to produce compound particles ranging in size from nearly 0.1 mm down to 10 μ average diameter. The compound particle size increased as the mold temperature was increased from 25 to 230°C, but the effect was less than that of pouring temperature. Both steel and graphite molds yielded similar results. Rolling the castings broke up the dendritic structure of the alloys but did not reduce the size of the compound particles. Compacts of the alloy produced by powder metallurgy methods were sintered and rolled at temperatures up to 600°C. Al–U compound particle sizes from minus 150 mesh down to 8 μ were used, and both UAl_2 and UAl_3 were investigated. Neither the size of the compound particle nor their composition affected the hot working properties of the alloy. The compound UAl_2 was found to be unstable during sintering and rolling at temperatures above 500°C. The conversion of this compound to UAl_3 and UAl_5 did not adversely affect the hot-working properties of the alloy nor change the resulting size of the compound particles. (auth)

1978 CF-56-8-26
Oak Ridge National Lab., Tenn.
MTR FUEL ELEMENTS CONTAINING PLATES WITH Pu–Al ALLOY. R. J. Beaver. Aug. 3, 1956. Decl. Apr. 1, 1957. Contract [W-7405-Eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The first group of Pu–Al MTR fuel elements fabricated were rejected for excessive dimensions and blistering. The fuel element constitution and fabrication was reviewed, and a new Pu–Al ratio and revised rolling techniques were suggested. (D.E.B.)

1979 HKF-4
Ferguson (H. K.) Co., New York.
MACHINING OF URANIUM FOR BROOKHAVEN REACTOR. F. R. Kemmer, T. P. Musgrave, and G. E. Fox. June 15, 1949. Decl. Feb. 19, 1957. For Brookhaven National Lab. 95p. Contract AT-30-2-Gen-16, Subcontract AEM-S-26. $0.60(OTS).

Machining operations for extruded gamma-phase U rods for the Brookhaven Reactor are described. The disposal of U scraps by briquetting U turnings and health and safety procedures are explained. (F.S.)

1980 HW-3-1341
[Hanford Engineer Works, Richland, Wash.].
EXTRUSION PROCESS. Jan. 1, 1945. Decl. Mar. 13, 1957. 3p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A temporary extrusion process used at Hanford for extruding U metal is described. (L.T.W.)

1981 ISC-389(Del.)
Ames Lab., Ames, Iowa.
SLUG PROGRAM QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1953. P. Chiotti and O. N. Carlson. Aug. 12, 1953. Decl. with deletions Feb. 26, 1957. 32p. Contract W-7405-eng-82. $6.30(ph OTS); $3.00(mf OTS).

Preliminary results are reported on the coating of U by immersion in nonreacting molten Mg saturated with Zr, Ni, or Si. A corrosion analysis of the resulting Mg–Zr outer coat was performed on one failure occurring in boiling water. Further experiments are described on the corrosion testing of Cu-plated and Zn-dipped U. Improvements in the Zn-dip process are uncertain, however, because hot-dip Zn coats show comparable corrosion characteristics. Investigations have been conducted on the casting of U in cans of Zr, U, and Nb–U alloys. Information was accumulated on the nature of the bonding characteristics, thermal treatment, and corrosion testing of such canning techniques. A new series of U–Nb alloys has been prepared for the purpose of studying the phase transformations of U. Data are given for the fabrication, phase characteristics, and physical and chemical properties of the series. Resistance-temperature curves were determined for U–Mo alloys, in addition to studies of corrosion and grain size in U–Zr–Nb alloys. A method is proposed for determining the thermal conductivity of U from diffusivity measurements. (C.H.)

1982 ISC-453
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN METALLURGY FOR OCTOBER, NOVEMBER, DECEMBER 1953. May 25, 1954. Decl. Mar. 28, 1957. 48p. Contract W-7405-eng-82. $0.40(OTS).

Progress is reported on the following investigations: separation of Nb and Ta by solvent extraction; separation of Ti and Nb with TBP, and of Hf from Zr with methyl ethyl ketone; preparation of HfF_4, CeF_3, LaF_3, $ThCl_4$, and V chlorides; preparation of Ce, La, V, Nb, anf Hf; phase studies of U–Zr, U–Ag, U–Nb, V–Al, V–Ta, Th–Mg, Zr–Zn, and Ta alloys; corrosion of high-melting metals and alloys by liquid U–Cr and Mg–Th alloys; casting U into U–Zr alloy cans; coating and electroplating of U; reactions of U with Al–Si alloys at high temperatures; corrosion of U–Zr–Nb alloys in water; crystal structure of sodium tungsten bronze; physical properties of Dy; and phase studies of CaO-CaF_2 systems. (C.W.H.)

1983 KAPL-960(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
ZIRCONIUM-GAS REACTIONS AND EFFECTS ON PROPERTIES AT ELEVATED TEMPERATURES. H. T. Sumsion. Feb. 26, 1954. Decl. with deletions Feb. 26, 1957. 74p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

Available information on the reactions of zirconium with gases has been reviewed. It appears probable that zirconium reacts with all except the inert gases at elevated temperatures. With all except hydrogen no appreciable attack occurs below 400°C within periods up to a few hundred hours. Above this temperature zirconium reacts with air, oxygen, nitrogen, carbon dioxide, carbon monoxide, water vapor, propane, ammonia, and sulfur dioxide; in all cases the reaction rate increases rapidly with increasing temperature. The reaction products are, in general, soluble in the metal and influence its physical properties. The use of zirconium is not recommended at temperatures above 400°C when exposed to non-inert atmospheres. Corrosion resistance of zirconium is particularly sensitive to extremely small nitrogen content. The alloying addition of small amounts of tin to zirconium is effective in overcoming this nitrogen corrosion sensitiveness. Hydrogen reacts with zirconium, to some extent even at room tem-

perature, to produce hydrides and a zirconium–hydrogen solid solution. The hydrides decompose at temperatures of 440°C and above. Hydrogen can be removed from zirconium by annealing at suitably high temperatures under proper vacuum. Hydrogen in limited amounts has no appreciable effect on tensile strength and ductility of zirconium, but in amounts as low as 10 ppm has an embrittling effect upon the impact strength. No significant improvement by alloy additions to the heat resistance of zirconium at elevated temperatures has been found. Anodic oxide films have been reported to give good protection to zirconium against absorption of atmospheric gases by the metal at temperatures up to 300°C. (auth)

1984 KAPL-1100(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLIC COATINGS ON URANIUM BY SPUTTERING AND EVAPORATION. W. D. Davis. Apr. 1, 1954. Decl. with deletions Feb. 25, 1957. 35p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Adherent corrosion-resistant metallic coatings have been applied to uranium by a combination of cathodic sputtering for cleaning the uranium surface and evaporation or sputtering to deposit the coating metal. Evaporated chromium coatings gave the most satisfactory results and, with suitable heat treatment, resisted corrosion in boiling water for an average of over 200 hours. Sputtered coatings were inferior to evaporated coatings. (auth)

1985 KAPL-1564(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGY REPORT OF THE TECHNICAL DEPARTMENT [FOR] MARCH, APRIL, MAY 1956. C. A. Bruch and W. M. Cashin. Decl. with deletions Feb. 25, 1957. 45p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30 (mf OTS).

The U–Zr phase diagram is presented. Melting points of B and other oxides above 2000°C were determined. The structure of Ca and Sr aluminates was refined, and Al_2O_3–UO_2 bodies were fabricated. Techniques for impregnating leached unfired Vycor are being standardized. The effects of radiation on hardness of Vycor and on Pu–U oxides have been obtained. (C.H.)

1986 KAPL-1604(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGY REPORT OF THE RESEARCH OPERATION [FOR] JUNE, JULY, AUGUST 1956. C. A. Bruch and W. M. Cashin. Decl. with deletions Feb. 26, 1957. 59p. $7.80(ph OTS); $3.30(mf OTS).

A study of U–Zr delta phase structure was made. The preparation of fast oxide breeder fuel elements by cold extrusion and firing is described. Experimental results on UO_2 with PuO_2 and TiO_2 additions were made. The effects of foreign atoms, H_2, temperature, and creep on strain cycling behavior of U was investigated. The production of a fine-grained, equiaxed as-cast structure in Be-base dilute alloys, the effectiveness of Zr coating on spherical U powder, the effect of irradiation on the mechanical properties of metals, argon diffusion in potassium-lime-silica glass, and the fabrication of tensile specimens of U–Zr alloy are reported. (J.E.D.)

1987 KAPL-M-EDL-8
Knolls Atomic Power Lab., Schenectady, N. Y.
FABRICATION OF A BERYLLIUM SLAB. P. R. Matthews. July 25, 1952. Decl. Feb. 14, 1957. 16p. Contract W-3[1]-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A slab was constructed that corresponded to 7.43 in. of solid Be. A steel container was filled with Be pellets to an average density of 77.9 lb/ft^3 or 67.5% of theoretical Be density. More uniform Be density was obtained by hand loading. Analysis of the uniformity of Be density of means of x rays proved feasible; a comparison of solid Be with Be pellets was obtained and used to verify the 67.5% theoretical density. (auth)

1988 KAPL-M-LLW-1
[Knolls Atomic Power Lab., Schenectady, N. Y.]
MEMORANDUM ON URANIUM TITANIUM ALLOYS. L. L. Wyman. Sept. 19, 1949. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A series of four U–Ti alloys containing 15, 26.4, 35, and 45 wt. % Ti were run in the precision differential dilatometer. With the possible exception of the high temperature transformation in the 15% Ti alloy, all the changes took place over an appreciable range of temperature. (W.L.H.)

1989 KLX-10021(Del.)
Vitro Labs., West Orange, N. J.
ELECTROKINETIC PROCESSES—NUCLEAR ASPECTS. Quarterly Progress Report for November 1, 1955–January 31, 1956. Dept. of Chemical Research and Development. Vitro Job 2018. H. F. Reichard, J. J. Shyne, H. G. Scheible, and H. Vartanian. Feb. 15, 1956. Decl. Mar. 28, 1957. 13p. Contract AT(30-1)-850. $0.25(OTS).

Three Mo-coated Inconel control specimens have been prepared. A large scale tube furnace and isostatic die have been assembled to facilitate the coating of three 1½ in. diameter bearing shafts for corrosion tests in fused salt. Preliminary samples of developmental pin-type metallic nuclear fuel elements have been prepared by the electrophoretic technique. Studies are continuing to test the possible general use of the protein, zein, as a binder, stabilizer and activator in electrophoretic dispersions. (auth)

1990 M-4409
California. Univ., Berkeley. Radiation Lab.
THE MELTING AND CASTING OF URANIUM IN SULFIDE CRUCIBLES. E. D. Eastman, Leo Brewer, LeRoy A. Bromley, Paul W. Gilles, and Norman L. Lofgren. July 24, 1945. Decl. Mar. 6, 1957. 7p. Contract [W-31-109-eng-52]. (MB-LB-12B-6). $1.80(ph OTS); $1.80(mf OTS).

Uranium was successfully cast at temperatures as high as 1900 to 2000°C in crucibles made from CeS, $CeS_{1.33}$, ThS, $ThS_{1.75}$, and $ThU_{0.7}S_2$ with the sulfur pickup in all cases less than 0.15 wt. %, in some cases at low temperatures being less than 0.005%. A summary of actual sulfur absorption for different experimental temperatures and crucible types is given. The effect of the molten mixture of U and UBr_3(Br/U =2) upon some sulfide refractories was investigated. The results indicate that only ThS_2 and divalent sulfides like $ThUS_2$, US, ThS, etc., would withstand the U–UBr_3 mixture. Uranium may be separated from metal salt mixtures ($CaCl_2$, $SrBr_2$, BaI_2, etc.) by distillation of the salt and fusion of the U in a sulfide crucible. (auth)

1991 MIT-1114
Massachusetts Inst. Of Tech., Cambridge. Metallurgical Project.
TECHNICAL PROGRESS REPORT FOR THE PERIOD JULY THROUGH SEPTEMBER 1953. Nov. 24, 1953. Decl. Feb. 25, 1957. 132p. Contract AT(30-1)-981. $0.75(OTS).

Bend tests have revealed that beryllium sheet can be made by cross rolling of extruded powder flats which has high ductility in two directions in the plane of the sheet. Direct experiment has shown that nitrogen will penetrate much farther into a bed of hot beryllium powder than does carbon monoxide. Extensive thermal cycling tests have shown that the growth per cycle is smallest at the front end of an alpha extruded bar of uranium and increases uniformly toward the back end. The coarse grains sometimes produced by alpha extrusion occur first at the leading end of the bar and at the

surface. The coarse grains show much less cycling growth than the fine grains. Corrosion testing of epsilon uranium-silicon alloy is in progress. Zirconium appears to scavenge carbon and nitrogen from molten uranium through flotation of carbides and nitrides. Zirconium is relatively resistant to molten U–Cr alloy. A fairly successful radiator casting was made with zirconium tubes which were in contact with U–Cr at 1000°C for five minutes. An extensive report on recrystallization of crystal bar zirconium as a function of percentage reduction and of annealing temperature for different lengths of time is given. Zirconium cladding of graphite by dipping in molten zirconium has given some promising results. It has been shown that the corrosion resistance of Bureau of Mines zirconium is reduced by quenching from temperatures in the vicinity of the alpha-beta transformation. Chromium from the Bureau of Mines was extruded at 1900°F. All tests to date have shown that it is brittle at room temperature. (auth)

1992 NMI-1160
Nuclear Metals, Inc., Cambridge, Mass.
THE URANIUM–SILICON EPSILON PHASE. Terminal Report. S. Isserow. Sept. 1, 1956. Decl. Apr. 12, 1957. 15p. Contract AT(30-1)-1565. $0.50(OTS).

The effect of other elements on epsilon phase composition and the interaction of the epsilon phase with Zircaloy during coextrusion are briefly discussed. Attempts were made to homogenize U–Si billets by heat treatment for a week at 950°C. (L.T.W.)

1993 NYO-1186
National Research Corp., Cambridge, Mass.
A RESEARCH AND ENGINEERING PROGRAM FOR OBTAINING DESIGN INFORMATION REQUIRED TO BUILD PRODUCTION EQUIPMENT FOR REFINING AND CASTING THORIUM. A. E. Franks. June 11, 1952. Decl. Mar. 1, 1957. 28p. $4.80(ph OTS); $2.70(mf OTS).

Production equipment capable of consolidating dezincing, melting, and casting Th as a single operation was determined. Modification of an existing furnace for this purpose and experimental results from runs are reported. (C.H.)

1994 ORNL-1774
Oak Ridge National Lab., Tenn.
DIFFUSION CHARACTERISTICS OF THORIUM AND ALUMINIUM. J. A. Milko. Dec. 30, 1954. Decl. Feb. 23, 1957. 43p. Contract W-7405-eng-26. $0.40(OTS).

Diffusion Characteristics were investigated between thorium and aluminum. The objective of the investigation was to develop information which might serve as a guide in the construction of assemblies for a converter type of reactor utilizing aluminum-clad thorium plates. Extent of the diffusion was evaluated by a measurement of the thickness of the resulting diffusion layer formed between these two metals, in intimate contact, in vacuum. An appreciable amount of diffusion was observed between thorium and aluminum, particularly in the temperature range of 500 to 600°C. Barriers of aluminum–silicon alloys were not effective in minimizing the diffusion. Alloying of the thorium with beryllium, zirconium, chromium, cerium, vanadium, molybdenum, niobium and tin was not beneficial in decreasing the extent of the diffusion. Alloying of the aluminum with beryllium, chromium, cerium, magnesium plus chromium (52 S) was likewise not effective in reducing the extent of diffusion. Barriers of magnesium and nickel, inserted between the thorium and aluminum seemed to have increased the extent of the diffusion. Barriers of zirconium and titanium foil appear to decrease the extent of diffusion at temperatures up to 500°C. At 600°C, the extent of diffusion between zirconium and aluminum is appreciable, while that of titanium and aluminum is somewhat less. Bonding of zirconium and titanium to thorium first occurs at 650°C. From 650°C to 850°C the extent of diffusion between thorium and zirconium or titanium is small. (auth)

1995 ORNL-1875(Del.)
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION SEMIANNUAL PROGRESS REPORT [FOR] PERIOD ENDING OCTOBER 10, 1954. W. H. Bridges, ed. Aug. 31, 1955. Decl. Mar. 2, 1957. Decl. Mar. 2, 1957. 78p. Contract W-7405-eng-26. $12.30 (ph OTS); $4.50(mf OTS).

A study was made of fiber-texture type of preferred orientation in extruded Al rods and brass sheeting. Experiments to purify Zr by the zone-melting techniques were studied. Several transformation products of the decomposition of the β eutectoid of the Ag–Zr system were identified. The tempering of the martensitic structure of a hypoeutectoid Ag–Zr was studied. Metallurgical treatments for the recovery of U from spent stainless steel fuel elements were investigated. Physical properties and radiation stability of the Si–SiC fuel element material were investigated. The development and fabrication of a uniform fuel-bearing sandwich plate were continued. Methods of welding stainless steel were studied. An evaluation study was made of brazing alloys on the basis of corrosion resistance, neutron economy, flow temperature, availability, and cost. (C.H.)

1996 SRO-13
Horizons, Inc., Cleveland.
RESEARCH AND DEVELOPMENT IN THE FIELD OF THORIUM CHEMISTRY AND METALLURGY. VOLUME III. COST ESTIMATE FOR 1,000 TON/YR. THORIUM METAL PRODUCTION PLANT. Final Report. James L. Wyatt. June 30, 1956. Decl. June 6, 1957. 41p. Contract AT(30-1)-1335. (HZ-100) $7.80(ph OTS); $3.30(mf OTS).

The described plant will produce reactor grade Th at a price of $1.07 per pound. The plant operation is based on the preparation of electrolytic cell feed by fused salt chlorination techniques and converting the feed to high quality metal by high temperature electrolysis. (D.E.B.)

1997 SRO-16
Horizons, Inc., Cleveland.
RESEARCH AND DEVELOPMENT IN THE FIELD OF THORIUM CHEMISTRY AND METALLURGY. Monthly Progress Report [for] May 16 thru June 15, 1955. James L. Wyatt. July 1, 1955. Decl. Mar. 14, 1957. 66p. Contract AT(30-1)-1335. (HZ-30) $10.80(ph OTS); $3.90 (mf OTS).

An internally heated chlorinator using a bed of graphite as a resistor element in contact with molten salt was shown to be feasible. An extended run was completed in an electrolytic cell demonstrating the feasibility of continuous operation. Other studies are reported on chlorination of thorium oxycarbonate and physical metallurgy evaluations of the Th produced. (T.R.H.)

1998 TID-5424
[Du Pont de Nemours (E. I.) & Co.] Savannah River Lab., Augusta, Ga.
METALLOGRAPHY OF THORIUM. W. E. Johnson and R. P. Marshall. Dec. 10, 1954. Decl. Mar. 14, 1957. 7p. (DPST-54-569). $1.80(ph OTS); $1.80(mf OTS).

Techniques for producing as-polished surfaces for inclusion studies and etched surfaces for grain studies are outlined. (D.E.B.)

1999 TID-7507(Del.)
Division of Reactor Development, AEC.
THE 1955 MEETING OF AEC WELDING COMMITTEE, SAVANNAH RIVER PLANT, SEPTEMBER 7-8, 1955. July 1956. Decl. with deletions Feb. 5, 1957. 248p. $33.30(ph OTS); $9.60(mf OTS).

The following reports were presented at the meeting of AEC Welding Committee; Welding of Type 347 Steels; Importance of Weld Composition and Hot Ductility with Respect to Austenitic Weld Cracking; An Evaluation of the Corrosion and Oxidation Resistance of High-Temperature Brazing Alloys; Welding Problems Associated with the Construction and Operation of the MTR; Radiation Effects on Welds and Notches in Plain Carbon Steels, Stainless Steels, and Nonferrous Alloys; and Some Nondestructive Testing Methods for Testing Welds. (J.E.D.)

2000 WAPD-51(Rev.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE TENSILE PROPERTIES OF ZIRCONIUM ALLOYS AT FABRICATION TEMPERATURES AND STRAIN RATES. C. R. Simcoe and D. E. Thomas. Mar. 18, 1952. Decl. Mar. 7, 1957. 30p. Contract AT-11-1-GEN-14. $0.35 (OTS).

The stress-strain curves of various types of Zr were obtained at strain rates of 220/min. at temperatures from 260 to 1100°C. The effects of transformation, aging, iron impurities, and strain rate were investigated. The application of these data to fuel element fabrication was described. (auth)

2001 WAPD-123
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
MANUFACTURE OF U–Mo RODS FOR IRRADIATION AT CHALK RIVER IN THE X-2 LOOP. W. B. Haynes. May 26, 1955. Decl. Feb. 7, 1957. 17p. Contract AT-11-1-Gen-14. $0.25(OTS).

Zircaloy-2 clad Uranium–12 wt. % Mo rods were fabricated for testing in the X-2 loop at Chalk River. The fuel was duplex melted. The rods were manufactured by co-extruding the fuel alloy in Zircaloy cups to size. End closures on individual rods were made by resistance butt welding and fusion welding over the resistance butt weld. (auth)

2002 WAPD-FE-452
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR FLAT ROD MANUFACTURE BY FORGING. Report on Experiment 11v1. R. E. Droegkamp. Sept. 15, 1954. Decl. Mar. 19, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Hammer forging of co-extruded Zircaloy-2 clad 12 wt. Mo–U rod to a flat shape at temperatures ranging from room temperature to 1900°F has been unsuccessful because of fracturing of the fuel and poor dimensional uniformity during forging. Press forging has resulted in no fracturing of the fuel and fair dimensional uniformity. In both types of forging operation, the as-extruded fuel-clad bond remained intact. (auth)

2003 WAPD-FE-456
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EXTRUSION OF UNCLAD NATURAL URANIUM AND MOLYBDENUM–NATURAL URANIUM ROD FOR TRX. Report on Experiment 7c4. R. W. Tombaugh. Sept. 29, 1954. Decl. Mar. 19, 1957. 20p. $4.80(ph OTS); $2.70 (mf OTS).

Extrusion of unclad billets of both natural U and 12 wt. % Mo natural U was employed for producing unclad rods subsequently machine finished to .600" diameter and to random lengths which were fitted into assembly 4' long. Indications are that the extrusion of unclad natural U and its alloys is feasible within certain qualifications. (auth)

2004 WAPD-FE-493
[Westinghouse Electric Corp.] Atomic Power Div., Pittsburgh.
INFORMATION REGARDING 12 ZIRCALOY-2 CLAD UO_2 FILLED RODS TRANSFERRED TO THE METALLURGY SUBDIVISION FOR IRRADIATION DAMAGE STUDY. B. E. Schaner. Oct. 23, 1954. Decl. Mar. 19, 1954. 5p. $1.80 (ph OTS); $1.80(mf OTS).

Fabrication information and dimensional data are reported for 12 Zircaloy-2 clad UO_2 filled rods intended for irradiation damage studies. (L.T.W.)

2005 WAPD-FE-1005
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE STRAIN SENSITIVITY OF SOME MECHANICAL PROPERTIES AND FAILURE CHARACTERISTICS OF ZIRCALOY-2 TUBING. L. F. Cochrun. Sept. 14, 1955. Decl. Apr. 15, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

2006 WAPD-MDM-7
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE EXTRUSION OF ARC MELTED SPONGE HAFNIUM CRUCIFORM SHAPES. J. Halapatz. May 5, 1954. Decl. Mar. 19, 1957. 11p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

An experimental extrusion of an arc melted Bureau of Mines sponge Hf billet to a cruciform shape was unsuccessful. While the use of arc melted sponge Hf in the fabrication of control rods by extrusion does not appear feasible, additional experimental work is felt necessary to provide a more conclusive evaluation. (auth)

2007 WAPD-NCE-524
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
EXTRUSION OF BARE HAFNIUM. E. L. Richards and R. W. Tombaugh. May 4, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

Results from a series of extrusions made to determine optimum conditions are presented. (D.E.B.)

2008 WAPD-PWR-PMM-601
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RÉSUMÉ OF URANIUM ALLOY DATA—XI. E. F. Losco and J. Belle, eds. Feb. 1, 1956. Decl. Mar. 13, 1957. 66p. Contract AT-11-1-GEN-14. $0.40(OTS).

Results from studies of irradiation induced transformations in U–Mo and U–Nb alloys are reported. Progress in the development of a satisfactory brazing technique using Al alloy for use with U_3Si rods in Zircaloy-2 tubes is reviewed. Additional data are given on the corrosion of bare of U–Si systems in water. Work directed toward the development of satisfactory UO_2 for fuel elements is reviewed. (D.E.B.)

2009 WAPD-PWR-PMM-625
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RESUMÉ OF URANIUM ALLOY DATA—XII. E. F. Losco, J. Belle, E. K. Halteman, and L. J. Jones, eds. May 1, 1956. Decl. Mar. 13, 1957. 57p. Contract AT-11-1-GEN-14. $0.40(OTS).

Additional information was obtained on U_3Si radiation effects and corrosion properties in water. The use of an Al alloy barrier layer between U_3Si and Zr prevented the formation of ZrSi interdiffusion layers, but introduced a brittle UAl_3 compound. Fission gas emanation from UO_2 in-pile specimens was reduced ten-fold by increasing its density from 92 to 96.5% of theoretical. (D.E.B.)

2010 WAPD-RM-96(Del. 2)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
ZIRCONIUM INGOTS ARC MELTED FROM VARIOUS TYPES OF ZIRCONIUM SCRAP. E. S. Foster and W. J. Hurford. Nov. 13, 1951. Decl. with deletions Mar. 12, 1957. 7p. Contract AT-11-1-Gen-14. $1.80(ph OTS); $1.80(mf OTS).

Experiments were performed to indicate the problems in cleaning and melting scrap Zr and to determine whether or not the ingots produced would meet specifications as to hardness, corrosion resistance, and chemical analysis. (L.T.W.)

2011 WAPD-T-308
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
IONIC TRANSPORT IN ZIRCONIUM OXIDE. L. D. Kirkbride and D. E. Thomas. Feb. 2, 1956. 8p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The voltage across growing oxide films on high purity crystal-bar Zr was determined as a function of temperature and type of atmosphere. The temperature range employed was 200 to 750°C. Pure O_2, dry air, and lab atmosphere were used at 760mm Hg as oxidizers. (T.R.H.)

2012 WAPD-T-407
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A PSEUDO-BINARY IN THE U–Nb–C SYSTEM. R. B. Roof, Jr., and J. J. Lombardo. Sept. 1956. 9p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

During the course of investigations on U–Nb–C systems by x-ray diffraction techniques, an impurity or an additional phase was observed in several alloys of various compositions. (W.L.H.)

2013 WAPD-T-415
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE METASTABLE GAMMA PHASE IN URANIUM BASE MOLYBDENUM ALLOYS. W. A. Bostrom and E. K. Halteman. Oct. 1956. 32p. $6.30(ph OTS); $3.00(mf OTS).

Prepared for presentation at 1957 Nuclear Engineering and Science Congress, March 10-16, Philadelphia.

The high-temperature γ phase of U is body-centered cubic and is stable to the melting point. Molybdenum is one of the body-centered cubic elements that tend to stabilize the γ phase. The phase diagram, structure of the γ′ phase, colorimetric measurements, thermal dilation and mechanical properties, electric resistivity, and effects of neutron irradiation were studied. (L.T.W.)

2014 WAPD-T-417
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE TRANSFORMATION KINETICS OF URANIUM–ZIRCONIUM ALLOYS CONTAINING 50 AND 60 WT PCT URANIUM. John J. Kearns. Nov. 21, 1956. 36p. Contract AT-11-1-GEN-14. $0.30(OTS).

The isothermal transformation kinetics of the high-temperature gamma phase in 50 and 60 wt. % U–Zr alloys have been investigated in the temperature range 200 to 580°C. Dilatometric, hardness, metallographic, and x-ray diffraction data have been obtained on samples quenched from the gamma-solution temperature directly to the isothermal-transformation temperature as well as on samples quenched first to room temperature and then reheated. Above 500°C, the transformation involves the formation and growth of an ordered phase, epsilon, and the precipitation of a small amount of alpha uranium. The gamma-to-epsilon reaction is very rapid, starting in a few seconds at 500°C. At lower temperatures the transformation also starts rapidly but progresses much more slowly. The mechanism of transformation at the lower temperatures is not clear, but the various data suggest a process similar to that occurring at higher temperatures. (auth)

2015 WAPD-TM-17
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRELIMINARY BETTIS PLANT SAFE PRACTICE GUIDE. FOR STORING, HANDLING, AND PROCESSING ZIRCONIUM AND ITS ALLOYS. Oct. 1, 1956. 15p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The purpose of this guide is to direct attention to the fire and explosion hazards associated with Zr and the Zircaloys and to emphasize the measures that should be employed to prevent the occurrence of such hazards. The recommendations and requirements presented are based on conclusions drawn from available reports or data as listed in the bibliography and from actual Zr fire experience. (auth)

2016 WASH-120(Del.)
Division of Research, AEC.
URANIUM ALLOY NEWSLETTER, NUMBER I. David W. Lillie. Jan. 29, 1953. Decl. with deletions Mar. 8, 1957. 54p. $9.30(ph OTS); $3.60(mf OTS).

In this first of a series of information letters on research progress in the field of U alloys, recent developments are reported by the various laboratories participating in the program. Argonne National Lab. Various phases of work on U–Zr alloys include casting, rolling, blanket- and fuel-slug fabrication, heat treatment, thermal cycling, and studies of stability under radiation and corrosion in water. Growth of U–Cr alloys under irradiation is briefly reported. Battelle Memorial Inst. The work reported on U–Zr alloys includes phase studies and the same subjects as for ANL, above. General Electric Co.–Hanford Works. The effect of various Cr additions on the dimensional stability of U under pile irradiation is tabulated. Knolls Atomic Power Lab. A series of U–C alloys was prepared and swaged into wire. Growth of these and of U–Cr wire under pile irradiation is reported. Length and surface changes of U, U–Cr, and U–Zr under thermal cycling and their corrosion in water are described. Los Alamos Scientific Lab. Several U–Ti alloys, with other additions, were prepared and their casting properties studied. Massachusetts Inst. of Tech. Preparation and extrusion of U–Zr alloy are reported. The thermal expansion of eutectic alloys of U–Cr and U–Fe are briefly discussed. National Bureau of Standards. The phase diagrams of U–Ag and U–Au were studied. Mallinckrodt Chemical Works. Derby melts of U–Mo are briefly reported. North American Aviation, Inc. Results of heat treating and thermal cycling of U–Zr alloy are tabulated. Sylvania Electric Products, Inc. Powder metallurgy of U and U–Zr, U–Al, U–Sn, and U–Si alloys is reported. Westinghouse Atomic Power Div. U–Zr, U–Si, and U–Mo alloys have been corrosion tested in boiling water and autoclave-tested at 600°F, in the as-melted, homogenized and quenched, and homogenized and furnace-cooled conditions. (D.E.B.)

PHYSICS

2017 AECU-3352
New Mexico. Univ., Albuquerque.
THE RESPONSE OF VIBRATION MOUNTS SUBJECTED TO BIHARMONIC VIBRATION (thesis). Paul H. Adams. [June] 1956. 82p. [For Sandia Corp. Contract AT-(29-1)-789.] $13.80(ph OTS); $4.80(mf OTS).

The problem investigated was the response of a linear spring-mass system and two vibration-mount systems when subjected to biharmonic vibration. The systems were vibrated on an electromagnetic vibration generator. Measurements of vibration amplitudes were made from oscillograph recordings of the double-integrated accelerometer output voltages. Double integration of the accelerometer output voltages was accomplished with operational analogues of a low natural-frequency, low damping-

coefficient simple system. The linear spring-mass system was vibrated at four base double amplitudes from 0.0015 to 0.0100 inch over the range of f/f_n values of 0.4 to 2.4. The amplification curves proved that the system had linear characteristics. The Barry type 990-30 vibration-mount system was vibrated at four base double amplitudes from 0.005 to 0.035 inch over the range of f/f_n values of 0.4 to 2.4. The shape of the amplification curves indicated that the system had nonlinear characteristics. The Barry type 780-35G vibration-mount system was vibrated at four base double amplitudes from 0.005 to 0.050 inch over the range of f/f_n values of 0.4 to 2.4. The shape of the amplification curves indicated that the system had nonlinear characteristics. The measured response of the spring-mass system which was subjected to biharmonic vibration agreed with the calculated response values based on the simple vibration-amplification curve. The measured responses of the type 990-30 vibration-mount system which was subjected to biharmonic vibration were between 9 and 27% lower than the most conservative calculated response values. The measured responses of the type 780-35G vibration-mount system which was subjected to biharmonic vibration were less than 4% lower than the most conservative calculated response values. (auth)

2018 ANL-4680

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION QUARTERLY REPORT FOR JUNE, JULY AND AUGUST, 1951. Sept. 1, 1951. Decl. Apr. 2, 1957. 65p. Contract W-31-109-eng-38. $10.80(ph OTS); $3.90(mf OTS).

Thermal-neutron scattering and transmission cross sections of U^{235}, U^{238}, Th^{232}, P^{31}, Ti, F^{19}, and He were measured. Approximate resonance parameters are found for the absorption resonance in U^{235} at 7 ev. The transmission dips of U^{235} as determined by the velocity spectrometer are compared with those obtained at Columbia. The σ thermal (238) was calculated from the rabbit flux, via values for thin Au, and agrees well with the latest value for U^{238} obtained at Oak Ridge. Values for the K/L ratio for Sm^{150} and Gd^{odd} were obtained on a film densitometer. The multiplicity and capture cross section of Hf^{177}, Hf^{179}, and normal Hf were measured with a pair of scintillation counters in coincidence. Neutron transmission cross sections were measured with about 2-kev resolution in the energy range 2 to 25 kev with a new design of neutron-detector. Resonances were observed in Na, Ti, V, Mn, Fe, Co, and Ni. An absolute measurement was made of the thermal-neutron absorption cross section of B. The crossover transition ratio in Te^{123} was measured to check the Weisskopf theoretical value $\lambda_{E5}/\lambda_{M4} = 7 \times 10^{-2}$. The following activities were measured: 12-min Nd^{151}, 27.5-hr Pm^{151}, 15-min Mo^{101}, 16-min Tc^{101}, and 3.5-min Se^{79}. The energy of a γ ray which is associated with the 20-sec isomeric state of Sc^{45} was measured spectrographically. Product compounds formed by recoil iodine atoms in dilute solutions of ethyl iodide in benzene and iodine in benzene are CH_3I^{128}, $C_2H_5I^{128}$, and $C_6H_5I^{128}$. Yield and fraction of positive Au recoil atoms are measured for retarding field of only 22.5 v. The Mo isotopes in a 5.3-yr-old Zr fission sample are given. The half life for a double β decay was determined for the reaction $Te^{130} \rightarrow Xe^{130} + 2\beta$. The ion emission from alkali halides and the binding energy of these complex ions were determined by measuring the equilibrium constant for their dissociation at various temperatures. The argon age of Essonville granite was determined to be 0.6×10^9 years. Computations made on the threshold values of the conversion coefficients for the K shell are tabulated. The pressure calculated from the free energy using the generalized Fermi-Thomas model for arbitrary temperatures is shown to agree with that found by mechanical considerations based on the same model, and expressions are also obtained for the entropy and the specific heat. Results of preliminary observations of the α and γ rays from the reaction $B^9(p,a)Li^6(\gamma)Li^6$ are reported. (W.L.H.)

2019 KAPL-247(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

PROGRESS REPORT NO. 37 [FOR] AUGUST 1–31, 1949. Sept. 23, 1949. Decl. with deletions Mar. 7, 1957. 95p. Contract W-31-109-Eng-52. $15.30(ph OTS); $5.40(mf OTS).

Brief statements covering various phases of the work in physics, chemistry, chemical engineering, metallurgy, engineering, shipboard reactor studies, and health physics are made. (F.S.)

2020 KAPL-M-EDL-40

Knolls Atomic Power Lab., Schenectady, N. Y.

CALIBRATION STEAM GENERATOR PITOT TUBE. D. J. Eldredge. May 26, 1953. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The calibration curves of a Cole type pitometer design for flow measurements in the Steam Generator System. (auth)

2021 LA-1289

Los Alamos Scientific Lab., N. Mex.

A STUDY OF AN ACCIDENTAL RADIATION BURST. R. W. Paine, Jr., R. S. Dike, J. D. Orndoff, and D. P. Wood. Mar. 20, 1951. Decl. Mar. 26, 1957. 33p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

An accidental burst of radiation occurred at the laboratory on 1 February 1951 during remote control operation of a critical experiment. There was no personnel hazard. Normal operations were resumed within 24 hr, and the active material involved in the burst returned to service within three weeks. An unforeseen brief excursion into the prompt critical region was engendered in the act of scramming the assembly at the end of a series of measurements. This report describes the effects of the burst and analyzes the probable causes in some detail. (W.L.H.)

2022 NBS-D-124

National Bureau of Standards, Washington, D. C.

QUARTERLY PROGRESS REPORT FOR APRIL, MAY AND JUNE 1953. Sept. 1953. Decl. Mar. 8, 1957. 59p. $9.30(ph OTS); $3.60(mf OTS).

The accomplishments to date on development of Zamboni type piles are summarized. Oblique attenuation experiments on Au^{198} confirm recent literature reports of γ lines of 1.08 and 0.68 Mev. Preliminary results are reported on the slowing down of monoenergetic fast neutrons in H_2O. Testing of a Landsverk pocket dosimeter Model L-38 is reported. Calibration of β-ray applicators is discussed. Work on development of an x-ray-pattern amplifier is summarized. Additional information is reported on stored-energy determinations on irradiated and unirradiated graphite and related materials. Preparation of Be dimethyl and Be diphenyl is discussed, and the solubility and reactivity of Na phenyl in organic materials were studied. A summary is presented of all aryl silanes which have been synthesized. Work is reported on the synthesis of picene, triphenylene, and coronene. Phase studies are reported on U-Ag, U-Ti, and U-Au alloys and the following systems: UC-Be_2C-C, U-C, UO_2-CuO, UO_2-V_2O_5. Temperature-emf relations of a Ta-W thermocouple from 1000 to 2000°C are presented. The essential features of a high-temperature strip-resistance furnace and an x-ray-diffraction furnace are shown. (For preceding period see NBS-D-123.) (L.M.T.)

2023 ORNL-1732(Rev.)
Oak Ridge National Lab., Tenn.
STABLE ISOTOPE RESEARCH AND PRODUCTION DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MAY 20, 1954. Aug. 9, 1954. Decl. Mar. 2, 1957. 62p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

The Isotope Analysis Methods Laboratory reports on the measurement of 16 new nuclear magnetic resonance frequency ratios. Previously measured fundamentals in the infrared spectrum of HCOF were verified by a study of deutero-formyl fluoride. A kinematic mount was designed for the rapid and precise adjustment of a concave grating. Tests on 12 different phototubes were run for direct-reader use, and a phototube power supply was designed to provide 600 to 2000 volts d-c, with a ripple of <0.02%. The nuclear spin of U^{235} has been revised to $I = 7/2$. The first Zeeman effects for Pu are reported. A hollow cathode ion source and power supply were developed for particular application to spectrochemical and spectroisotopic analyses. X-ray-diffraction data on $UO_3HPO_4 \cdot 4H_2O$ and $UO_2(H_2PO_4)_2 \cdot 3H_2O$ were obtained The Mass Spectrometer Lab. reports on the development of In filaments for vaporizing solid materials in the ion source of a mass spectrometer. A number of advantages resulting from this feature are discussed, including the efficient generation of positive Ni ions from samples of only 1 μg. A series of ARE fuel samples have been investigated mass spectrographically in order to determine the loss of U by burnup and corrosion. The design and performance of a new 6-in. mass spectrometer are described. The Stable Isotope Separation Research and Calutron Operations Dept. reports on the calutron separation of of K, La, Hf, Zr, Cr, and Ni. The Stable Isotope Chemistry Research and Production Dept. reports on the calutron separation and refining of several metals, and the development of processes for the separation of rare earths. (F.S.)

2024 WAPD-CTA(RM)-312
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FRICTION FUNDAMENTALS OUTLINE. N. B. Dewees. Nov. 29, 1955. 19p. Project 26c15. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The development of friction theory has been rapid, sometimes controversial, and from many sources over the past 20 years so that one has difficulty in learning the present state of thinking in this field. This report gives the more generally accepted concepts which, along with the modifying conditions, can rationalize and perhaps predict most friction phenomena and give some insight into wear. The first part of the report gives in brief form the physical picture of what takes place; the second portion gives the numerous modifying effects; the third portion states the rules for friction phenomena and some of the closely related rules for wear. The body of the report may serve as an outline for those already familiar with the subject. For the newcomer to the field, the reference numbers give not only the original sources of the material, but also serve as guides to brief abstracts of pertinent information, these to be found in the Appendix. (auth)

Crystallography and Crystal Structure

2025 KAPL-749(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
AN X-RAY STUDY OF THE EFFECT OF FISSION EVENTS ON THE CRYSTAL STRUCTURE OF SOLIDS. Charles W. Tucker, Jr., and Peter Senio. Apr. 30, 1952. Decl. with deletions Feb. 26, 1957. 58p. Contract W-31-109-eng-52. $7.80(ph OTS); $3.30(mf OTS).

A comprehensive account is given of the study by x-ray diffraction techniques of neutron-irradiated uranium dioxide uranium metal, and boron carbide. The irradiations range from one-half day to 25 days in the maximum thermal flux of the Brookhaven reactor and also include two irradiations in a Hanford reactor. Irradiation causes the diffraction lines of uranium dioxide to broaden considerably. Fourier analysis of the line shapes indicates that this broadening is due to grain fragmentation. In metallic uranium there is also line broadening due to irradiation, and Fourier analysis of the line shape indicates that in this case the broadening is due to a set of microstresses. The broadening in the metal is eliminated by annealing in the region of 500 to 600°C. The reaction of the B^{10} nucleus is shown to be highly analogous to the fission reaction. Hence, neutron irradiation of boron carbide showed a number of interesting effects. In a polycrystalline sample the diffraction lines broadened and decreased in integrated intensity. Lattice-parameter measurements showed that the boron carbide lattice expands due to the irradiation. Single crystals of boron carbide show an increase in the thermal diffuse scattering of the lattice and a decrease in the intensity of the Laue reflections due to the irradiation. These effects are removed by annealing in the region of 600 to 800°C. Two appendixes contain comprehensive discussions of the Fourier analysis of x-ray line shapes and temperature effects in x-ray diffraction patterns. (auth)

Electrical Discharge

2026 AECU-3395
Sandia Corp., Albuquerque, N. Mex.
DERIVATION FROM BOLTZMANN'S EQUATION OF THE SIMILARITY LAWS FOR GASEOUS DISCHARGES. T. E. VanZandt. [July 25, 1956]. 7p. Contract [AT-(29-1)-789]. $1.80(ph OTS); $1.80(mf OTS).

The similarity laws are derived by requiring that in two geometrically similar discharges the normalized distribution functions, and hence the Boltzmann equations for the normalized distribution functions, be the same function of the dimensionless coordinates of the two discharges. Also it is shown that if a discharge is stable, discharges similar to it are stable. (auth)

2027 LA-1850
Los Alamos Scientific Lab., N. Mex.
INFINITE CONDUCTIVITY THEORY OF THE PINCH. M. Rosenbluth, R. Garwin, and A. Rosenbluth. Sept. 14, 1954. Decl. Jan. 3, 1957. 35p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

With the assumption of infinite conductivity a simple model may be constructed for the dynamic construction of a current carrying plasma, i.e., the pinch effect. The magneto-hydrodynamic equations of this model are discussed and solved. It is also shown that the infinite conductivity model can be derived from a picture of particles orbiting without collisions in the fields set up by their motions. (auth)

Gases

2028 LA-1741
Los Alamos Scientific Lab., N. Mex.
ON THE CONDUCTIVITY OF IONIZED GAS. Emil J. Konopinski. Nov. 15, 1954. Decl. Apr. 2, 1957. 15p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

The conductivity of ionized gases is treated by a method similar to that used by Alfvèn in his book "Cosmical Electrodynamics." The results differ from those of Alfvèn. In

particular, it is shown that Alfvèn's conclusion, that whenever the Hall current disappears the conductivity becomes independent of the magnetic field, is not true in general. Moroever, it is not true under just the conditions of interest for the "Pinch Effect." The main conclusions of the present paper are (1) of currents down a tube, the ion component is the small fraction m/M of the electron current, regardless of the magnitude of the magnetic field; (2) the conduction along the tube depends on the transverse motion of neutral mass, i.e. on the radial velocity u_r of the gas in the tube, according to $j = \sigma (\epsilon + u_r H/c)$ where ϵ is the electric field directed along the tube and H is the magnetic field around the axis. (auth)

Isotopes

2029 CF-3211

Hanford Engineer Works, Richland, Wash.

CORRELATIONS AND PREDICTIONS CONCERNING THE RADIOACTIVE PROPERTIES OF HEAVY ISOTOPES. W. H. Sullivan and T. P. Kohman—I. Perlman, ed. Aug. 4, 1945. Decl. Feb. 16, 1957. 14p. Reissued under auspices of Contract W-7401-eng-37. (HW-3-3048; SE-PC-68). $3.30(ph OTS); $2.40(mf OTS).

Correlations of data concerning known heavy isotopes were made to predict the formation of other heavy isotopes in the pile. How these isotopes will affect chemical processing and Pu product is discussed. (T.R.H.)

2030 LA-2034

Los Alamos Scientific Lab., N. Mex.

FABRICATION PROCEDURE FOR RaLa SOURCE FUEL RODS. J. E. Hockett, J. D. Duncan, D. T. Doll, J. M. Taub, T. L. Crisler, and D. S. Fisher. Feb. 15, 1956. Decl. Apr. 2, 1957. 65p. Contract W-7405-eng-36. $0.50(OTS).

A new method to procure RaLa sources was proposed which depended upon irradiation of small-diameter U^{235} wire in the MTR. A procedure for cladding and sealing U^{235} wire in stainless steel tubing, by drawing, plugging the tube ends, and welding, was developed, tested, and proved to be satisfactory. The stainless steel-clad U^{235} wire was then encased in 2S Al tubing. A complete fuel rod assembly was fabricated by drawing a larger 2S tube over the inner 2S-stainless steel-U^{235} assembly. The outer 2S tube was then machined to provide longitudinal flutes. All bonds at metal-to-metal interfaces were determined to be satisfactory by radiographic examination. (auth)

2031 ORNL-612

Oak Ridge National Lab., Tenn.

THE PRODUCTION OF TRANSURANIC ISOTOPES IN THE MTR. H. E. Goeller. Mar. 15, 1950. Decl. Mar. 19, 1957, 34p. Contract W-7405-eng-26. $0.40(OTS).

The production of transuranic isotopes from the irradiation of U^{235} fuel assemblies in the MTR has been recalculated on the basis of a 12 day irradiation at a power level of 30,000 kw for a loading of 3.2 kg of U^{235}. (auth)

Isotope Separation

2032 A-2361

Standard Oil Co. of Indiana, Chicago.

MC MAHON PACKING. W. L. Forsythe, Jr., T. G. Stack, J. E. Wolf, and A. L. Conn. Nov. 17, 1945. Decl. Feb. 12, 1957. 34p. Contract W-7418-eng-41. $6.30(ph OTS); $3.00(mf OTS).

Tests of brass and Monel McMahon column packing with $C_6H_6-CH_2Cl_2$ and $BF_3-(CH_3)_2O$ are described. (T.R.H.)

2033 COO-19

Kansas. Univ., Lawrence.

PRODUCTION OF DEUTERIUM BY THE DISTILLATION OF LIQUID HYDROGEN. J. O. Maloney, H. E. Hughes, and N. G. Addington. July 1, 1950. Decl. Feb. 16, 1957. 25p. Contract AT(11-1)-47. $4.80(ph OTS); $2.70(mf OTS).

A survey was made of existing facilities for liquid hydrogen production. The purification of hydrogen streams and the feasibility of deuterium separation from hydrogen by low-temperature distillation are discussed briefly. Recommendations are made concerning engineering problems which require additional study. (L.T.W.)

2034 HKF-AED-100

Ferguson (H. K.) Co. Atomic Energy Div., New York.

PRELIMINARY COST ESTIMATE FOR QUANTITY PREPARATION OF BORON-10. Oct. 14, 1949. Decl. Feb. 19, 1957. 9p. $3.30(ph OTS); $2.40(mf OTS).

Of the three items in producing B^{10} (feed cost, separation plant cost, and product finishing) it was found that, per pound of B^{10} produced, the feed and raw materials will cost about $1500 (assuming return of waste BF_3 to manufacturer), the isotope separation will cost about $32, and the production of amorphous B from BF_3 will cost about $10. Of these items the last is the most uncertain. The over-all price per pound of B^{10} is about $57. (auth)

2035 Y-185(Del.)

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

CHEMICAL SEPARATION OF THE ISOTOPES OF URANIUM. R. W. Woodard, L. P. Twichell, D. A. Lee, P. B. Petretzky, J. S. Drury, R. D. Williams, F. V. Tilson, F. B. Waldrop, and G. H. Clewett. Aug. 1948. Decl. with deletions Mar. 6, 1957. 111p. Contract W-7405-Eng-26. $13.80(ph OTS); $4.80(mf OTS).

The enrichment of the isotopes of uranium has been successfully accomplished using chemical exchange reactions. Two such reactions have been utilized: the first involves a two phase liquid-liquid system in which a chloroform solution of an organic complex of uranium is contacted with an aqueous solution of tetravalent uranium ions, after the system has reached isotopic equilibrium, the phases are separated and the uranium recovered: the second is a single phase system, in water, wherein the separation of uranium is accomplished by an exchange reaction involving the exchange of uranium between U^{+4} and UO_2^{+2} ionic species. The separation effects obtained from these two reactions (each has a factor of about 1.001) are disappointingly low when considered from the possibility of adaptation to large scale processing, but the most significant feature of the work presented is the fact that measurable separation of the isotopes has been attained. Extensive efforts were made to utilize the liquid-liquid system in continuous column operation. These efforts were unsuccessful primarily because of the fact that the organic complexing agent, cupferron, was subject to oxidation, and the oxidation products prevented the smooth operation of the column. Considerable effort was made to find a more satisfactory organic compound which would be suitable for complexing the uranium and still not have the disadvantages associated with cupferron. Complete success was not attained, although the list of materials tested was large. Future work designed to increase this separation effect is outlined. (auth)

2036 Y-548

Carbide and Carbon Chemicals Div. Y-12 Plant, Oak Ridge, Tenn.

Y-12 RESEARCH LABORATORY PROGRESS REPORT [FOR] OCTOBER 1, 1949 TO DECEMBER 31, 1949. PART III. ELECTROMAGNETIC RESEARCH DIVISION. Jan. 3,

1950. Decl. Mar. 6, 1957. 78p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

During the last quarter of 1949 substantial progress is reported on the accelerator program. The small cyclotron was completed and used to obtain source performance and oscillator design information for the high current 86-in. cyclotron. The D-D neutron source was used to study the effect of neutron irradiation on germanium crystal rectifiers. The purification of U^{234} to above 90% was achieved. Measurements showed that careful handling of the associated high level alpha activity prevented any above-tolerance health hazards. Successful separation of isotopes by the "time of flight" (cyclorator) principle was achieved. Fundamental studies of arcs and ion current limits were carried out and are reported in the latter portion of this report. (auth)

Mathematics

2037 WAPD-T-175

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE GENERALIZED ONE-DIMENSIONAL SPACE SIMULATOR. R. R. Schiff. Apr. 1954. 17p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The space simulator is an electrical analog device for solving the two-group diffusion equations which occur in reactor theory. A space simulator has been constructed which permits solution of these equations in one space variable with space-dependent coefficients. The theory and design of this machine are described. (auth)

2038 WAPD-TM-18

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

RATES OF CONVERGENCE IN ONE-DIMENSIONAL CODES. Ely Gelbard. Oct. 1956. 12p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Measuring Instruments and Techniques

2039 IDO-16355

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

HIGH RESOLUTION FAST CHOPPER DETECTOR USING BF_3 COUNTERS. O. D. Simpson, R. G. Fluharty, and L. W. McClellan. June 18, 1956. 10p. Contract AT(10-1)-205. (PTR-89). $1.80(ph OTS); $1.80(mf OTS).

Time delays between signals from banks of BF_3 counters are used in the Materials Testing Reactor fast chopper to effectively reduce the counter length from 10 in. to 2 in. For the 45 meter flight path, this improves the instrument resolution from 0.13 to 0.05 μsec/meter for neutron energies greater than 10 ev without reducing the counter efficiency. An effective counter length of 2 in. in the neutron beam is normally used, and 1 in. (the counter diameter) can be used when needed. When the 1 in. effective length is used, the detector does not affect the instrument resolution at energies normally studied with the chopper Five counter banks of 16 counters each are connected in parallel with separate delays for four banks. The signals from the five banks are mixed and fed through a common amplifier after being delayed and amplified in separate preamplifiers. Pulse height distributions, gamma discrimination techniques, and other features are discussed. (auth)

2040 WAPD-RM-86

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REACTOR TESTS OF MARK I STR PROTOTYPE NUCLEAR INSTRUMENTS. William Baer, Robert T. Bayard, and Oliver F. Swift. July 1951. Decl. Feb. 22, 1957. 16p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Experiments performed in the CP-2 and CP-3 reactors of the Argonne National Laboratory with two enriched $B^{10}F_3$ proportional neutron counters and two enriched U^{235} fission counters are reported. The data indicate the necessity for withdrawal of these instruments from instrument thimbles when operating the reactor in the power range. A comparison is made of the sensitivity of the two types of instruments. (auth)

Meteorology

2041 TID-10081

Atomic Energy Commission, Washington, D. C.

AEC METEOROLOGICAL INFORMATION MEETING FEBRUARY 1-2, 1951. H. Newton, H. P. Munger, M. E. Smith, M. L. Barad, P. A. Humphrey, R. W. Houston, J. F. Newell, J. Z. Holland, C. A. Gosline, M. Eisenbud, R. C. Wanta, P. W. Allen, L. Machta, G. H. Strom, F. I. Badgley, D. L. Crowson, K. M. Nagler, H. Moses, and R. F. Myers. Aug. 8, 1951. Decl. Mar. 11, 1957. 103p. $0.50(OTS).

Meteorological factors are discussed which should be considered by the atomic energy industry in resolving such problems as site selection, plant locations and design, and the development and maintenance of facilities for the disposal of wastes. (C.H.)

Neutrons

2042 LA-1234

Los Alamos Scientific Lab., N. Mex.

ENERGY DISTRIBUTION OF FAST NEUTRON BEAM. Norris Nereson, Ester Allison, Julia Carlson, Pearl Norwood, and Dorothy Squires. Feb. 15, 1951. Decl. Mar. 26, 1957. 37p. Contract W-7405-eng-36. $0.35(OTS).

Experimental techniques are described for the spectral measurement of a collimated fast-neutron beam. A H_2-filled cloud chamber, proton-recording nuclear plates, and threshold fission foils were used as neutron detectors in the measurements. As an application of these techniques, the energy distribution and absolute flux of the fast neutron beam emerging from the Los Alamos fast reactor was measured from 0.1 to 18 Mev. (D.E.B.)

2043 LA-1445

Los Alamos Scientific Lab., N. Mex.

TIME DEPENDENCE OF THE SLOWING DOWN OF NEUTRONS WITH CONSTANT SCATTERING MEAN FREE PATH. G. I. Bell, H. A. Bethe, and W. B. Goad, Jr. May 31, 1952. Decl. Mar. 26, 1957. 14p. Contract W-7405-eng-36. $0.25(OTS).

Simple expressions are derived for the time dependence of the slowing down of neutrons in simple media. In Section I, a method suggested by age theory is used, while in Section II, a two parameter scattering function is employed. Results are compared with exact calculations. (auth)

2044 WAPD-P-91

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

TRANSPORT THEORY OF NEUTRONS. III. APPROXIMATION METHODS. Allan F. Henry. May 24, 1951. Decl. Mar. 13, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

This chapter of the "Transport Theory of Neutrons"

deals primarily with the Serber–Wilson method, an approximation which in accuracy and difficulty lies between the spherical harmonics and simple diffusion methods. (L.T.W.)

Nuclear Physics

2045 KAPL-1155(Vol. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
REPORT OF THE NUCLEAR PHYSICS SECTION FOR MARCH, APRIL, MAY 1954. Decl. Apr. 10, 1957. 36p. Contract W-31-109-Eng-52. $0.30(OTS).

A mass spectrometer for measurement of isotopic ratios has been designed and tested. A two-staged magnetic analyzer is used in order to obtain higher resolution by limiting the small-angle elastic scattering of ions by the gas molecules in the analyzing tube. Further analysis has been made of poisoning resulting from stable fission products in a thermal reactor. The following conclusions have been obtained: poisoning is predictable to within a factor of 2, with considerable improvement to be attained by a more accurate evaluation of the cross section for Zr^{93} and Sm^{151}; U^{235}, at exposures up to 30%, shows a linear dependence of poisoning roughly equivalent to 80b/fission; U^{233} produces 10 to 20% less poisoning than U^{235}; removal of gaseous fission products could eliminate 20 to 60% of the poisoning; the inclusion of neutron capture fission product descendents increases the poisoning by 50 to 100% at high burnups. (K.S.)

2046 ORNL-159
Oak Ridge National Lab., Tenn.
PHYSICS DIVISION PROGRESS REPORT FOR THE QUARTER JUNE, JULY AND AUGUST 1948. Decl. Mar. 20, 1957. 124p. Contract W-7405-eng-26. $19.80(ph OTS); $6.30(mf OTS).

2047 TID-10073
Los Alamos Scientific Lab., N. Mex.
ENERGY SPECTRUM OF NEUTRONS FROM THERMAL NEUTRON FISSION OF U^{235} AND FROM AN UNTAMPED MULTIPLYING ASSEMBLY OF U^{235}. Glenn M. Frye, Jr., Juanita H. Gammel, and Louis Rosen. May 1954. Decl. Mar. 18, 1957. 18p. Contract W-7405-eng-36. $0.25 (OTS).

The neutron fission spectrum of U^{235} was measured from 0.3 to 12.0 Mev using the method of proton recoils in nuclear emulsions. The resulting neutron spectrum may be represented by the formula $N(E) = 1.058 \cdot 10^3\, e^{-E/0.965} \sinh \sqrt{2.29E}$. The Godiva leakage spectrum was also measured and shows a higher proportion of low energy neutrons. (auth)

2048 Y-495
Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.
Y-12 RESEARCH LABORATORY PROGRESS REPORT [FOR] JULY 1, 1949 TO SEPTEMBER 30, 1949. PART III. ELECTROMAGNETIC RESEARCH DIVISION. Oct. 15, 1949. Decl. Mar. 6, 1957. 66p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

Plans for, and construction of, a high current, 25-Mev proton cyclotron were begun. It is planned that this machine will be capable of developing more than 1 ma of beam current, and will be useful for nuclear research and for preparing radioactive isotopes in quantity. The smaller 2-Mev test cyclotron installed in a Beta calutron vacuum tank is nearing its initial test. Yields of almost 10^9 neutrons/sec have been obtained from a low-voltage neutron source, using the D-D reaction. Evidence has been found for the absorption of deuterium in ordinary metal targets in such amounts as to simulate a target actually coated with a deuteride. In the field of fundamental investigations of arc discharges, several facts have become more firmly established: the mass-dependence of Child's space charge law is reproduced in measurements of accelerated beams for elements of different masses; the electron energy distribution in an arc is apparently distorted from the expected Maxwell distribution; one of the important effects of an increase in magnetic field on an arc is increased linear uniformity of intensity and of output. Final calutron processing of high purity U^{235} has been completed. Gram quantities of the isotope have been supplied to other research organizations. Preparation of highly concentrated U^{234} is in the second and final stage. The small quantities processed and the control of hazards from the dispersal of alpha active material has necessitated the development of special equipment and techniques pending continuation of the program. Facilities and techniques for the concentration of U^{236} have been prepared. Several proposed methods of isotope separation involving the use of electric and magnetic fields are under consideration. Of these, only the principle of separation-in-time (as applied in the cyclorator) has been subjected to experimental investigation. (auth)

Nuclear Properties

2049 BNL-250(Del.)
Brookhaven National Lab. Neutron Cross Section Compilation Group, Upton, N. Y.
NEUTRON CROSS SECTIONS. M. D. Goldberg, J. A. Harvey, D. J. Hughes, and V. E. Pilcher. Aug. 1, 1954. Decl. with deletions Mar. 15, 1957. 66p. $18.30(ph OTS); $6.00(mf OTS).

Most recent reliable data on several neutron cross sections for a variety of isotopes were collected in tabular and graphic form. The collection is intended as a revised version of BNL-170, and in addition to cross section information, contains tables of resonance parameters. (D.E.B.)

2050 HW-27851
Hanford Atomic Products Operation, Richland, Wash.
EXPERIMENTAL RESULTS OBTAINED FROM TEST PILE REACTIVITY MEASUREMENTS ON PLUTONIUM. Final Report on Production Test No. 305-2-N. H. W. Lefevre and J. R. Triplett. Apr. 28, 1953. Decl. Feb. 19, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Reactivity measurements to allow determination of the amount of poisoning produced by the Cd and Ta sleeves and to determine the relative loss of Pu^{239} when removing Pu^{240} are reported. (F.S.)

2051 IDO-16366
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ENERGY DEPENDENCE OF ETA FOR U-235 IN THE REGION 0.1 TO 8.0 ev. E. H. Magleby, J. R. Smith, J. E. Evans, and M. S. Moore. Nov. 19, 1956. 11p. Contract AT(10-1)-205. (PTR-142). $3.30(ph OTS); $2.40(mf OTS).

Measurements have been made of the energy dependence of eta, the number of fission neutrons emitted per neutron absorbed, for U^{233} in the energy region 0.1 to 8.0 ev. The U^{233} sample had an effective thickness to the beam of 6.9 g/cm^2. This metal sample was obtained on loan from the British Atomic Energy Research Establishment at Harwell. The MTR data are normalized to the Brookhaven slow chopper results. Dips are observed in the vicinity of each of the known fission resonances below 8 ev. Near the 2.3 ev resonance, eta dips nearly to unity. (auth)

Nuclear Reactors

2052 AECD-4242

Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn.

RESULTS OF EXPERIMENT 1 FCE CALIBRATION WITH BORAX CORE. E. Starr and E. C. Toops. Oct. 1, 1956. Decl. with deletions Mar. 16, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

The justification of using polyethylene whose hydrogen density of 0.132 gm/cm^3 with a distributed void of 15.9% as a mockup of water at 70°F and having a hydrogen density of 0.111 gm/cm^3 was tested. A mockup close to the BORAX core was built and its critical mass determined. Corrections were calculated for differences in the hydrogen density and self shielding of the fuel. The effective FCE critical mass agreed with that of the BORAX core to within one percent. (auth)

2053 AEP-37(Pt.I)

[Atomic Electric Project, St. Louis.]

REPORT ON GRAPHITE-SODIUM REACTOR FOR THE PRODUCTION OF PLUTONIUM AND USEFUL POWER. PART I. H. E. Gove and E. H. Nicholson, eds. June 13, 1952. Decl. Apr. 17, 1957. 103p. $0.55(OTS).

This feasibility study of a graphite-sodium power breeder reactor is based on a Hanford type reactor modified to Na cooling. The substitution of Na for water as coolant is evaluated in terms of power generation. Two fuel element designs are considered and the corresponding Na temperatures are calculated for the condition of maximum Pu production. Two tentative power ratings are derived, and the compatibility of Pu production and power production are investigated for these two ratings. The power cycles for the two power ratings are discussed. Preliminary estimates of the over-all economics of a dual prupose Na-graphite reactor plant are made. (auth)

2054 ANL-DHL-51

Argonne National Lab., Lemont, Ill.

KINETICS. Experiment 27. W. Olliff. Mar. 23, 1953. Decl. Feb. 12, 1957. 12p. $3.30(ph OTS); $2.40(mf OTS).

In order to obtain information pertaining to the delayed photoneutrons, and their effect on the reactor shutdown, the reactor was operated for various lengths of time, and scrammed with the same amount of negative reactivity in each case. The neutron flux due to spontaneous fission was obtained by measuring the flux when the reactor was subcritical. The instruments used to read the power levels of the reactor were calibrated in terms of the average flux throughout the reactor. Measurements of the period, due to the same amount of excess k for various lengths of operating time, were made. This was repeated for different amounts of excess k. (auth)

2055 ANL-FWT-105

Argonne National Lab., Lemont, Ill.

HAZARD EVALUATION REPORT ON THE FAST REACTOR ZERO POWER EXPERIMENT (ZPR-III). R. O. Brittan, B. Cerutti, H. V. Lichtenberger, R. Rice, and F. W. Thalgott. Apr. 1955. Decl. Feb. 13, 1957. 75p. Contract W-31-109-eng-38. $2.00(OTS).

A fast zero power assembly is planned to obtain neutron physics information for fast power breeder reactor designs. The systems to be studied are blanketed cores having a range of volume fractions of U^{235}, U^{238}, Fe, and Na. Volume fractions are varied by arranging small pieces in drawers of two square arrays mounted in such a way that they may be brought together for criticality. The assembly is described, the extensive safety measures designed to prevent prompt criticality are discussed, and the effects of the maximum forseeable accident are evaluated. (D.E.B.)

2056 APEX-142(Rev.)

[General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.]

INTERNAL FUSES FOR LOW POWER REACTORS. T. W. Donaven and J. G. Stuart. [1957?]. Decl. May 1, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

Some discussion is presented on the need for and theory of internal fuses for quickly shutting down reactors. Particular emphasis is placed on the type of fuse that uses the energy from nuclear fission to trigger an auxiliary energy source which propels poison into the reactor. The similarity between this problem of propelling the poison into the reactor and a problem of ballistics leads to a division of the development of the fuse into the three following parts: trigger, primer, and propellant. The results of various experiments with shaped-charge explosive propellants are presented. (L.M.T.)

2057 BNL-285

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] NOVEMBER 16, 1953–FEBRUARY 15, 1954. Decl. Apr. 8, 1957. 44p. Contract [AT-30-2-GEN-16]. $0.40(OTS).

The theoretical work on liquid metal fuel reactors has been continued along the lines discussed in the last report, with emphasis on the development of improved methods for the calculation of core size and breeding gain as functions of fuel concentration. The study of the kinetics of LMFR systems has been continued. A 10 weight % Th–Bi slurry has been made and is fluid. The composition of the settled slurry is 14% Th, this represents an upper limit for fluid slurries. A temperature-cycled (350–600°C) 5% Th slurry shows a growth of particles from 15 to 30 μ in 100 hr. The special chrome-vanadium alloys stand up well in static corrosion tests in Bi and U–Br. None of the nine loops which are in operation have plugged this quarter. One ½-in. IPS loop, gradient 60°C, containing U, Mg, and Zr, has been in operation for 1650 hr without any indication of a plug forming. As a result of an intensified effort on the chemistry of the fuel process the oxidation-reduction behavior of fused-salt/liquid-metal systems is better understood. The object is to find a fused-salt/liquid-metal system which will transfer most of the rare-earth fission products to the salt phase at the same time that it holds essentially all the U in the metal. A prolonged experiment showed that Mg when added to the metal phase in the U–Bi/fused-salt system prevents transfer of the U to the salt phase. Apparently Mg, rather than U, is oxidized and transfers to the salt phase. The so-called "torch process" for extracting Pa and U is described. Two tracer runs made during the quarter showed that it is possible to extract the major portion of the Pa from ThF_4 powder in a single pass through the flame. At present, efforts are devoted to: (a) producing a flame powder of narrower particle-size range, (b) determining optimum flame temperature, (c) improving Pa recovery efficiency, and (d) improving torch design. Experiments on water-moderated, slightly enriched U lattices and the interpretation of these experiments are given. Measurements of buckling, migration area, fast fission factor, and thermal utilization have been continued. A method has been devised for measuring the critical buckling of lattices of different fuel elements (those containing Th or Pu, for example) by determining the critical size of a two-region assembly which has the new fuel in a small central region. Samples of graphite cored from the BNL reactor after the pile annealing experiment showed no stored energy in the 250°C region. The per cent recovery in physical dimensions and in c-axis for irradiated graphite

annealed at 250°C were almost identical. A horizontal continuous calciner is being built to study the processing of fission products. In this connection it has been found that sodium nitrate can be used as a fluxing agent with dried waste solids concentrating the fission product in the melt. (auth)

2058 CEPS-1121(Del.)
Commonwealth Edison Co. CEPS Group, Chicago.
A THIRD REPORT ON THE FEASIBILITY OF POWER GENERATION USING NUCLEAR ENERGY. June 15, 1953. Decl. with deletions Feb. 7, 1957. 104p. $1.05(OTS).

A technical evaluation was made of four reactor power plant designs. The evaluation was based on design data and cost estimates furnished by the originator of each design. In some cases the data were incomplete and estimates were substituted for data. The designs considered were the Sodium Graphite Reactor (North American Aviation); the Plutonium Power Breeder Reactor (Knolls Atomic Power Laboratory); Aqueous Homogeneous Reactor (Oak Ridge National Laboratory); and the Boiling Reactor (Argonne National Laboratory). (C.H.)

2059 CF-51-10-194(Del.)
Oak Ridge National Lab., Y-12 Area, Tenn.
THE H_2O MODERATED, SALT COOLED HETEROGENEOUS REACTOR. A. M. Weinberg. Oct. 8, 1951. Decl. with deletions Feb. 19, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A previous consideration of a salt-cooled version of the water-moderated reactor has led to this initial layout for a reactor in the 200 Mw class. (T.R.H.)

2060 CF-52-6-78
Oak Ridge National Lab., Tenn.
REACTOR PHYSICS OF TEAPOT [PART I]. P. R. Kasten. June 5, 1952. Decl. Feb. 13, 1957. 16p. Contract [W-7405-eng-26]. $0.30(OTS).

Initial criticality studies for boiling water reactor application are presented. The critical volume for a 17.5-in.-diameter experimental reactor using enriched UO_2SO_4 is calculated. Temperature and pressure effects are considered. (D.E.B.)

2061 CF-52-8-227(Del. 2)
Oak Ridge School of Reactor Technology, Tenn.
POWER FROM NA COOLED REACTOR; REACTOR DESIGN AND FEASIBILITY PROBLEM. D. R. Bennion, R. L. Hickmott, N. A. Krohn, W. J. McCarthy, R. A. Moore, H. J. Stumpf, and L. A. Waldman. Aug. 20, 1952. Decl. with deletions Mar. 11, 1957. 161p. $24.30(ph OTS); $7.50(mf OTS).

Work done on the study of a Na cooled, graphite moderated nuclear reactor for power production is summarized. The preliminary design calculations and results are described for a heterogeneous, thermal reactor using rod type fuel elements of slightly enriched U. The total heat capacity is 300,000 kw with a nominal electric power producing capacity of 75,000 kw. (auth)

2062 CF-52-10-79
Oak Ridge National Lab., Tenn.
POWER REMOVAL FROM A BOILING REACTOR. P. C. Zmola and E. N. Lawson. Oct. 9, 1952. Decl. Feb. 16, 1957. 13p. Contract [W-7405-eng-26]. $0.30(OTS).

This work is based on a rather specific and simplified model of the reactor core in which internal circulation exists. Because of the model simplicity, the influence varying some of the parameters appears more directly. In particular, calculation of the circulation factor, which is important in determining the need for vapor separators is included. On this basis it was felt desirable to make the results of this study available even though they have been largely superseded by the later work. (auth)

2063 CF-52-11-164
Oak Ridge National Lab., Tenn.
SCOPE OF P.B.R. STUDY. P. C. Zmola. Nov. 21, 1952. Decl. Feb. 15, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

2064 CF-53-3-206
Oak Ridge National Lab., Tenn.
BOILING REACTOR OPERATION. PART III. CRITICALITY REQUIREMENTS AND PLUTONIUM PRODUCTION RATES OF BARE, HOMOGENEOUS REACTORS. P. R. Kasten. Mar. 18, 1953. Decl. Apr. 12, 1957. 25p. $0.35(OTS).

Generalized plots of criticality requirements and plutonium production rates have been made for bare, homogeneous reactors, applicable to circulating and boiling types. With this information the influence of vapor within a reactor upon the operating conditions can be determined, which will aid in the economic evaluation of boiling reactors. (auth)

2065 CF-53-7-190
Oak Ridge National Lab., Tenn.
INTERPRETATION OF FISSION DISTRIBUTION IN ARE CRITICAL EXPERIMENT. Joel Bengston. July 20, 1953. Decl. July 18, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Data on fission distribution in a fuel tube from the ARE critical experiment are fitted with analytic representations suggested by heterogeneous pile theory and by transport theory. Comparison with the thermal flux calculated from the composition of the materials indicates that transport theory must be used to obtain qualitative agreement with experiment. The ratio of average to maximum fission density in the fuel tube is found to be 0.855 ± 0.012. (auth)

2066 CF-53-8-226(Del.)
Oak Ridge School of Reactor Technology, Tenn.
CONSIDERATION OF A 30,000 KW HETEROGENEOUS BOILING REACTOR POWER PLANT. Reactor Design and Feasibility Problem. A. S. Ginsburgh, J. J. O'Connor, N. A. Petrick, A. Stathopolis, J. L. Wallace, J. E. Werle, E. C. Woodward, and F. A. Fanelli. Aug. 14, 1953. Decl. with deletions Feb. 14, 1957. 220p. $34.80(ph OTS); $9.90(mf OTS).

The objectives of the study were to consider the feasibility of a 30,000 kilowatt reactor plant producing steam at a pressure and temperature consistent with modern steam power practice, to consider that the steam produced in the active reactor core will be supplied directly to the turbine, to utilize, only those engineering materials which have well known properties, and to specify the primary problems in engineering and nuclear physics peculiar to this application which require future research. (auth)

2067 CF-55-8-194(Del.)
Oak Ridge School of Reactor Technology, Tenn.
THORIUM ROD BLANKET STUDY FOR THERMAL BREEDER REACTOR. H. C. McCurdy, R. J. Akin, E. L. Alexanderson, J. P. Davis, J. D. Fitzgibbons, and J. O. Kolb. Aug. 1955. Decl. with deletions Feb. 15, 1957. 187p. $1.00(OTS).

A two-region thermal breeder consisting of a homogeneous core of $U^{233}O_2SO_4$ in D_2O and a blanket of Th rods suspended in D_2O is investigated from the standpoint of the economics of such a reactor as a central station power producer. Blanket thickness and Th concentration are optimized, and the optimized Th rod blanket reactor is compared with a similar reactor having a ThO_2 slurry blanket. From this comparison, power costs are found to be about 9% higher in the case of the Th rod blanket. A novel blanket design consisting of rotating cylindrical

assemblies is suggested as a method for reducing Pa^{233} losses, and some aspects of the design of such a blanket is considered. (auth)

2068 CF-55-11-66
Oak Ridge National Lab., Tenn.
TEST ELEMENT FOR APPR CRITICAL EXPERIMENT. J. G. Gallagher, H. G. Blosser, and J. E. Mann. Nov. 9, 1955. Decl. Mar. 21, 1957. 6p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The Army Package Power Reactor critical experiment employs separate fuel, boron, and steel plates. The fuel plates consist of 0.002 in. × 2.5 in. × 22 in. enriched uranium foil clad with stainless steel. The boron plates consist of B_4C in a matrix of iron clad with stainless steel. In the APPR, the uranium and boron will be present in a stainless steel matrix as UO_2 and B_4C equally distributed in all plates. Detailed drawings of the test element are presented. (L.T.W.)

2069 CF-55-11-165
Oak Ridge National Lab., Tenn.
PRELIMINARY RESULTS OF APPR CRITICAL EXPERIMENTS. PART II. D. V. P. Williams. Nov. 29, 1955. Decl. Feb. 22, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Preliminary results of measurements of APPR neutron flux and power distributions are presented. (W.L.H.)

2070 CF-56-7-148
Oak Ridge National Lab., Tenn.
PRELIMINARY REPORT OF CRITICAL EXPERIMENTS IN SLAB GEOMETRY. J. K. Fox and L. W. Gilley. July 30, 1956. Decl. Apr. 1, 1957. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The critical parameters of aqueous UO_2F_2 solutions enriched to 90% U^{235} in various arrays of interacting slab geometries have been determined for a single concentration. Critical solution heights for various configurations of three nominally 3-in. thick Al slab vessels and one 6-in. Al slab vessel were determined. (T.R.H.)

2071 COO-92
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT [FOR] APRIL 1952. (Job. 57). May 1, 1952. Decl. Feb. 16, 1957. 20p. Contract AT(11-1)-217. $4.80 (ph OTS); $2.70(mf OTS).

Proposed process studies for D_2O recovery and decontamination of UO_2SO_4 solutions and for the conversion of UF_6 to UO_2SO_4 are given. Results of batch tests on the decontamination of UO_2SO_4 are tabulated. (B.J.H.)

2072 CRD-T4A-24
California Research and Development Co., Livermore, Calif.
EFFECT OF INTRODUCING THE FAST NEUTRON SOURCE WITHIN THE LATTICE. [D. H. Imhoff]. [June 1, 1951]. Decl. Feb. 16, 1957. 3p. $1.80(ph OTS); $1.80(mf OTS).

Calculations were made of the neutron flux at the surface of a reactor matrix when a fast neutron source is within a graphite moderated lattice. (C.H.)

2073 GEAP-2(Del.)
General Electric Co. Atomic Power Equipment Dept., Schenectady, N. Y.
HOMOGENEOUS CIRCULATING FUEL REACTOR POWER PLANT: CONCEPTUAL DESIGN STUDY REPORT. May 31, 1955. Decl. Feb. 25, 1957. 108p. $16.80(ph OTS); $5.70(mf OTS).

A preliminary design study is reported for an aqueous homogeneous circulating fuel power reactor. The plant output was specified as 100 Kw net electric output and 400 Kw of heat in hot water for space heating. Subjects investigated include: reactor physics, fuel chemistry, heat transfer and stress analysis, reactor vessel design. Power plant arrangement and equipment selection were covered along with system thermodynamic analysis and electrical system design. (auth)

2074 HW-33531(Del.)
General Electric Co.
Hanford Atomic Products Operation, Richland, Wash.
THE NUCLEAR POWER INDUSTRY—A STUDY OF INFLUENCING FACTORS. W. K. MacCready, W. J. Dowis, K. L. Robertson, and J. R. Wolcott. Jan. 31, 1955. Decl. with deletions Mar. 11, 1957. 212p. Contract W-31-109-eng-52. $36.30(ph OTS); $10.20(mf OTS).

Factors which will tend to influence the establishment and growth of a nuclear power industry have been studied. Influencing factors fall within three areas of consideration: technical and engineering; economic and financial; and statutory, regulatory, and administrative. A conceptual design of a nuclear power plant employing a water-cooled, graphite-moderated reactor as the heat source has been presented as an example and has been used for illustrative purposes in presenting a discussion of factors. Discussion of factors has developed the magnitude of both favorable and unfavorable influences and, to the extent possible, means for emphasizing favorable influences and minimizing unfavorable ones have been suggested. It has been possible to visualize practicable means for achieving technical and engineering; economic and financial; and statutory, regulatory, and administrative conditions which would permit initiation of nuclear power plant projects. Further, it has been possible to visualize putting these means into use quickly enough to make immediate initiation of some number of such projects feasible. It has not seemed likely that the feasibility visualized will be apparent to industry generally without a very considerable exertion of effort on the part of the Commission to eliminate, or at least minimize, the impact of rather easily seen unfavorable influences. (auth)

2075 IDO-16146
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MTR STRUCTURE TEMPERATURES WITH 3 × 9 LATTICE—1953. G. H. Hanson and A. V. Grimaud. Feb. 18, 1954. Decl. Mar. 27, 1957. 41p. Contract AT(10-1)-205. $0.35(OTS).

The Materials Testing Reactor operated at 30 Mw, the design power level, throughout 1953. A 3 × 9 arrangement of the fuel assemblies was used until November 20 when a 5 × 6 lattice was introduced. No structure temperatures were observed which exceeded the maximum permissible levels for the various components of the reactor. The highest temperature observed in the graphite-ball zone was 175° F which is definitely below 300°F, the limiting operating temperature for a significant volume of graphite. The maximum variation of the observed thermal-shield temperatures was 18°F. The maximum design variation within a given section of the thermal shield was 33°F, and the resulting calculated thermal stresses were considered acceptable. The highest operating temperature in the concrete biological shield was 99°F, which was less than 30°F above the temperature of the reactor room. From thermal-stress considerations the maximum acceptable temperature difference within a concrete structure is approximately 50°F. A master set of structure temperatures for 1953 is presented, and the temperature distributions within the various components of the reactor are analyzed. The master sets of structure temperatures for

1952 and 1953 have been compared. Permanent facilities for measuring the emf's of the structure thermocouples were installed during the early summer. A double ice-junction was provided for each thermocouple in order to eliminate thermocouple junctions at the selector switch and the potentiometer. With these facilities the agreement between duplicate measurements, with a time interval of one hour or greater, for most locations was within 0.5°F, and for many temperature points the variation was less than 0.2°F. (auth)

2076 IDO-16209(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR TECHNICAL BRANCH QUARTERLY REPORT [FOR] THIRD QUARTER, 1954. J. R. Huffman. Dec. 21, 1954. Decl. with deletions Feb. 26, 1957. 23p. Contract AT(10-1)-205. $4.80(ph OTS); $2.70(mf OTS).

High activity levels have developed in the process water system of the MTR, indicating fission breaks in the fuel assemblies. Examination of fuel assemblies after use shows blemishes on the outer surface of the outer fuel plates. Not all elements have blemishes nor are there any apparent statistics favoring one position in the reactor. The theory is that high temperature corrosion due to low water flow on the outside of fuel assemblies is the cause. The top and bottom end boxes of several elements were punctured with holes to encourage higher outside flows. This seems to alleviate, but not eliminate, the cause. Work on this is continuing as rapidly as possible. A more sensitive method for monitoring the process water for fission products has been developed. A side stream of water is passed through cation and anion beds. A gamma ray scintillation counter views the anion bed. By biasing out all activities below 1 Mev, only the short-lived iodine activities are measured (mainly 6.7-hour I^{135}). This technique cuts out the high background normally induced in the water and thus gives higher sensitivity. In addition, since it measures only short-lived activities, it records the average rate of production of fission products in the system. The cross section work during this period has been aimed at developing techniques for measuring fission cross sections and eta values on the crystal and time-of-flight spectrometers. Preliminary values of the ratio $\sigma f_{239}/\sigma f_{235}$ from 0.035 ev to 0.3 ev have been obtained. In the total cross section field, preliminary values for Np^{237} were determined. The activation cross sections of Pa^{233} have been investigated by radiochemical techniques. Large resonance activation integrals have been discovered which greatly affect the value of the cross section. The studies on graphite damage as a possible fast flux monitor have been terminated. The measurement of Co spacing changes seems to be in the range most useful in MTR exposures. (auth)

2077 IDO-16348

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A CRITICAL FACILITY FOR THE ETR—A PROPOSAL. D. R. deBoisblanc. Mar. 5, 1956. 11p. Contract AT (10-1)-205. (PTR-50). $3.30(ph OTS); $2.40(mf OTS).

This proposal describes a zero-power critical facility which will be a mock-up of the Engineering Test Reactor Reactor core. The purpose of this facility, which is reflected in the conceptual design, is to provide an assembly which will duplicate the ETR in respect to: (1) critical mass, (2) flux distribution, (3) fuel weighting function, (4) poison weighting functions, and (5) arrangement of experimental assemblies. In addition, the flexibility is such as to permit determination of ETR excess reactivity, cycle times, and reactivity hazards for certain reactor and experiment failures. It is proposed to house the facility in a Service and Test building. The preliminary cost estimate exclusive of building, fuel and beryllium reflector is $105,000. It is intended that the fuel shall be standard ETR elements and that 36 MTR beryllium A-pieces will serve as reflectors. (auth)

2078 IDO-16352

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ETR-TYPE CORE STUDIES IN THE MTR-REACTIVITY MEASUREMENT FACILITY. E. Fast and E. E. Burdick. May 18, 1956. 61p. Contract AT(10-1)-205. (PTR-69). $10.80(ph OTS); $3.90(mf OTS).

Studies on various ETR-type cores in the RMF were requested by G. E. for the purpose of checking their Univac calculations for the Engineering Test Reactor presently under construction at the MTR site in Idaho. Tests in the RMF included critical mass determinations on several type cores, flux distribution in the lattice and in a grey rod consisting of half poison–half fuel, and temperature coefficient measurements. This report presents data obtained in these tests, with discussions on the experimental procedure and probable errors involved. (auth)

2079 K-318

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

DETECTION OF SLUG RUPTURE. A. E. Johnson, Jr., J. Sandock, I. Spiewak, and R. G. Stirling, Jr. Dec. 3, 1948. Decl. Mar. 19, 1957. 20p. For Oak Ridge National Lab., Tenn. Contract [W-7405-eng-26], Subcontract 70. $3.30(ph OTS); $2.40(mf OTS).

A survey was made of the possible methods of detecting ruptured slugs in the Oak Ridge National Laboratory low flux pile, and recommendations were made as to the most promising procedure for locating them in the pile. (auth)

2080 KAPL-251

Knolls Atomic Power Lab., Schenectady, N. Y.

AUTOMATIC CONTROL SYSTEM FOR INTERMEDIATE REACTOR. J. H. Pigott and J. I. Owens. Sept. 20, 1949. Decl. Feb. 26, 1957. 34p. Contract W-31-109-eng-52. $0.30(OTS).

The development of an automatic control for the WMA Reactor is described. The system is a closed control loop in which a reflector rod is actuated by neutron flux level. (auth)

2081 KAPL-294

Knolls Atomic Power Lab., Schenectady, N. Y.

THEORETICAL ESTIMATE OF MAXIMUM POSSIBLE NUCLEAR EXPLOSION. H. A. Bethe. Jan. 31, 1950. Decl. Feb. 22, 1957. 31p. Contract W-31-109-Eng-52. $6.30 (ph OTS); $3.00(mf OTS).

The maximum nuclear accident which could occur in a Na-cooled, Be moderated, Pu and power producing reactor is estimated theoretically. (T.R.H.)

2082 KAPL-908(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

KAPL STUDY OF HETEROGENEOUS PLUTONIUM POWER REACTORS. R. Ehrlich and E. A. Luebke. May 1, 1953. Decl. with deletions Mar. 15, 1957. 58p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

Results of nuclear calculations for a variety of compositions of fast, heterogeneous, sodium-cooled, U-235-fueled, plutonium- and power-producing reactors are reported. Core compositions typical of plate-, pin-, or wire-type fuel elements and with uranium as metal, alloy, and oxide were considered. These compositions included atom ratios in the following range: U-238 to U-235 from 2 to 8; sodium to U-235 from 1.5 to 12; iron to U-235 from 5 to 18; and vanadium to U-235 from 11 to 33. Calculations were per-

formed to determine the effect of lead and iron reflectors between the core and blanket. Both natural and depleted uranium were evaluated as the blanket fertile material. Reactors were compared on a basis of conversion ratio, specific power, and the product of both. The calculated results are in general agreement with the experimental results from fast reactor assemblies. An analysis of the effect of new cross-section values as they became available is included. (auth)

2083 KAPL-1173(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
NEUTRON FLUX DISTRIBUTION CALCULATIONS USING THE $P^{(3)}$ SPHERICAL HARMONIC METHOD. J. W. Weil. July 10, 1954. Decl. with deletions Feb. 25, 1957. 31p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The P_3 spherical harmonic method is discussed as a technique for obtaining a more accurate description than is provided by diffusion theory of the neutron flux distribution in cylindrical geometry. An improved formulation of the P_3 technique is described, and the results of calculations for various lattice types are given. (auth)

2084 KAPL-M-DED-3
Knolls Atomic Power Lab., Schenectady, N. Y.
STEADY-STATE OPERATING TEMPERATURES OF THE REACTOR SECONDARY SAFETY. D. E. Davidson and J. J. Kauzlarich. June 18, 1953. Decl. Mar. 9, 1957. 15p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

The temperature distribution in the center of the Mo control rod tubing of an intermediate Na cooled reactor was calculated for two rod-end positions: the top matrix and reflector interface and 2 ins. above the matrix-reflector interface. The method of calculation is discussed, and the results are plotted. (D.E.B.)

2085 KAPL-M-EDL-22
Knolls Atomic Power Lab., Schenectady, N. Y.
SHOCK TESTS: CONTROL CYLINDER. A. B. Briggs, Jr. Feb. 10, 1953. Decl. Mar. 11, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The shock resistance of the mechanical structure supporting the Be in the SIR Mark A control cylinder is reported. Vibration tests were made at a frequency and amplitude providing 12 g accelerations. The unit was also tested on a shock machine with increasingly heavy blows. No visible damage was produced in the test unit. The shock resulting from the seventy-four 2,000 ft-lb blows received on the shock machine is considerably in excess of the specified shock. (L.T.W.)

2086 KAPL-M-EDL-82
Knolls Atomic Power Lab., Schenectady, N. Y.
IRRADIATION CAPSULE THERMAL TEST. J. M. Marshall. Nov. 1, 1954. Decl. Mar. 12, 1957. 13p. Contract W-31-109-Eng-52. $13.30(ph OTS); $2.40(mf OTS).

An irradiation capsule, designed for irradiating fuel elements in the MTR, was satisfactorily thermal tested. (T.R.H.)

2087 KAPL-M-EDL-107(Pt. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
HOT SODIUM TEST OF THE S2G ROTATING PLUGS. PART I. PROGRAM REPORT. Oscar D. Terrell. Nov. 28, 1955. 56p. Contract [W-31-109-Eng-52]. $9.30(ph OTS); $3.60(mf OTS).

Planning, execution and results of the test program are summarized. The test results were satisfactory in that the Rotating Plugs met all the design specifications, also, the required tests were completed ahead of schedule. Detailed results were obtained from leak test, frozen sodium seal pressure tests, pressure drop tests of water cooling coils, rupture test of the frozen sodium seal with no cooling water, melting of the sodium seal with shield oil removed (the regular operating procedure) and with shield oil left in (special procedure), refueling conditions test with no cooling water, mechanical tests, jacking and rotating the rotating plugs, and additional information as acquired throughout the program. (auth)

2088 KAPL-M-EPF-1
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIATION SURVEYS DURING PROOF TEST REACTOR AND THERMAL TEST REACTOR OPERATIONS. E. P. Forest. Apr. 1956. Decl. Feb. 13, 1957. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Radiation levels in areas adjacent to the Proof Test Reactor and Thermal Test Reactor are reported as detected during operations at 19 w and 10 kw, respectively. Maximum weekly exposures amounting to 3% of the maximum weekly permissible limit have been received by operating personnel during operation of the PTR at 100 w for two hours. Maximum weekly personnel exposures amounting to 53% of the maximum weekly permissible limit have been received during operation of the TTR at 10 kw for 24 hr. Special neutron monitoring devices are not required by PTR operating personnel under current operating conditions. The TTR survey indicates need for the wearing of special neutron monitoring devices by control-room personnel and personnel working about the north thermal column. (auth)

2089 KAPL-M-JHS-2
Knolls Atomic Power Lab., Schenectady, N. Y.
IMPROVEMENT OF CPC THREE-GROUP, THREE-REGION REACTOR CALCULATIONS TO INCLUDE HIGHLY ABSORBING REFLECTORS AND BLANKETS. Jack H. Smith and Charles D. McKereghan. Mar. 22, 1954. Decl. Mar. 27, 1957. 11p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

The CPC coding as originally employed to handle three-group, three-region reactor calculations has been revised to provide an accurate treatment for highly absorbing reflectors. As now instructed, the machines will correctly handle configurations in which the reflector region is completely unlimited with regard to geometric size and both scattering and absorption properties. (auth)

2090 KAPL-M-KGC-2
Knolls Atomic Power Lab., Schenectady, N. Y.
PILE CONTAINER. K. G. Carney, Jr. July 14, 1950. Decl. Mar. 14, 1957. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Considerations preliminary to design of a leakproof container for the Schenectady Intermediate Pile to include reflector, blanket, and coolant are given. (T.R.H.)

2091 KAPL-M-LBV-8
Knolls Atomic Power Lab., Schenectady, N. Y.
AN INSTRUMENT TO MEASURE SIMULATED TEMPERATURES IN THE S3G EMERGENCY COOLING TEST LOOP. L. B. Vandenberg and L. A. Hagen. June 8, 1956. 15p. [Contract W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

In order to complete an analysis of the S3G emergency cooling system, experimental information is needed concerning the nature of the mixing process between adjacent slugs of hot and cold water flowing through the primary coolant pipes. Preliminary investigations have shown that it is practical to simulate temperature differences in the water using a salt solution to represent the cold dense water and pure water for the less dense hot water. One of the original fluids is identified by a dye so that the mixing process can be observed optically by means of color

sensitive phototubes. The output of the phototubes will then be proportional to the simulated temperature in that part of the mixing zone under observation. The purpose of this memo is to describe recently developed instrumentation that can detect the color changes in the mixing zone and record them in degrees Fahrenheit. This instrumentation and apparatus is designed for use with a test facility which is a full scale mock up of S3G emergency coolant flow. (auth)

2092 KAPL-M-PLH-3
Knolls Atomic Power Lab., Schenectady, N. Y.
MULTIGROUP PROCEDURES AS USED AT KAPL. P. L. Hofmann. Mar. 27, 1952. Decl. Feb. 11, 1957. 59p. $9.30(ph OTS); $3.60(mf OTS).

The basic procedures of the multigroup method are described. Applications are presented which were used in criticality calculations for spherical reactor assemblies. (C.H.)

2093 KAPL-M-RTF-3
Knolls Atomic Power Lab., Schenectady, N. Y.
PTR ZERO-POWER REACTOR TRANSFER FUNCTION. R. T. Frost and R. J. Schemel. Aug. 1955. Decl. Mar. 2, $3.30(ph OTS); $2.40(mf OTS).

A simple method of measuring reactor transfer functions is described. Results of application of the new technique to the Proof Test Reactor mock of the Submarine Intermediate Reactor Mark A are given. A method is derived for analysis of the data for prompt generation time and the shape of the delayed neutron kernel. (auth)

2094 KAPL-M-RWL-2(Rev.)
[Knolls Atomic Power Lab., Schenectady, N. Y.]
PRELIMINARY HEAT TRANSFER-FLUID FLOW CALCULATIONS FOR THE KAPL REACTOR MAY 1949. R. W. Lockhart. Decl. Mar. 18, 1957. 146p. $22.80(ph OTS); $7.20(mf OTS).

Work performed during a two-year period (1946 to 1948) on the development of reactor cooling systems is summarized. A preliminary feasibility report is presented on the KAPL Intermediate Power Breeder Reactor cooling systems. Topics discussed include: the reactor coolant systems problems; reasons why Na and NaK were chosen as coolants; heat removal system operation at various reactor operating power levels; analyses of the proposed fuel rods during reactor operation, unloading and assumed fouled conditions, as well as reflector and breeding blanket temperature distribution and coolant requirements; test results of the full scale, 60°, top of the reactor water flow model; a description of the standby coolant system for the West Milton reactor, and the 60°, full scale, liquid metal, mockup for Sacandaga; the development of the gas cooling system for the concrete shielding; the graphite test hole area; the design of a Na pipe and reactor container heating and leak detection system; and an analysis of the primary heat removal system for the West Milton reactor at the design reactor output coolant temperature of 750°F, and reduced reactor temperatures. (C.H.)

2095 KAPL-M-SMS-16
Knolls Atomic Power Lab., Schenectady, N. Y.
ELIMINATION OF SPECIAL GAS REQUIREMENTS OF S3G/S4G PLANT. A. Lagani, Jr. Feb. 9, 1956. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The analytical studies made to eliminate the addition of hydrogen corrosion inhibitor to the Submarine Advanced Reactor are summarized. It is recommended the hydrogen form cation portion of the mixed bed resin be replaced by ammonium form and that the makeup water be deaerated by the existing feed water dearator in series with a demineralizer. This scheme will provide a hydrogen level of 40 cc/kg, and offers other advantages. (T.R.H.)

2096 KAPL-M-SMS-18
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR PRESSURE AND ISOLATION VALVE CLOSURE FOLLOWING A POSSIBLE LEAK IN THE PRIMARY COOLANT SYSTEM OF S3G. C. W. Sorenson. Mar. 1, 1956. 40p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

A study was made to determine primary system pressure and operation of the valves in the process of isolating a leak in the S3G (submarine reactor) system. (L.T.W.)

2097 KAPL-M-SMS-28
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G MAIN COOLANT SYSTEM PRESSURE DROP AND FLOW. D. R. Eifert and W. C. Smith, Jr. June 8, 1956. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70 (mf OTS).

2098 KAPL-M-SMS-30(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
PROPOSED S3G HULL ISOLATION SAFEGUARDS REQUIREMENTS. L. A. Savastio and H. E. Stone. Dec. 10, 1956. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

A re-evaluation of the requirements for the Submarine Advanced Reactor hull isolation system based on certain credible incidents is given. The consequences of the accidents are described along with benefits of the present charging system and of a proposed emergency injection system. Recommended design changes and additions are outlined. (T.R.H.)

2099 KAPL-M-SMS-33
Knolls Atomic Power Lab., Schenectady, N. Y.
PERFORMANCE AND OPERATIONAL CHARACTERISTICS OF THE S3G WATER BRAKE. L. A. Savastio. Aug. 31, 1956. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The theoretical aspects and operational procedures involved in controlling and operating the Submarine Advanced Reactor (S3G) load absorbing water brake are outlined. (L.T.W.)

2100 KAPL-M-SMS-35 and Add. I
Knolls Atomic Power Lab., Schenectady, N. Y.
DESIGN EVALUATION OF THE L-42 LOOP (TF-57). Aug. 30, 1956. 100p. (Add. I attached. Dec. 6, 1956. 12p.) Contract W-31-109-Eng-52. $19.80(ph OTS); $6.30(mf OTS).

The L-42 loop is a stainless steel test facility consisting of in-pile and out-of-pile sections circulating coolant water through the in-pile section. The loop accommodates one cluster of seven full-length test fuel elements, and the primary purpose of the facility is to determine the performance and endurance of the test fuel elements under steady-state burnup conditions. (L.T.W.)

2101 KAPL-M-SMS-40
Knolls Atomic Power Lab., Schenectady, N. Y.
TRANSIENT S3G/S4G STEAM DRUM WATER LEVEL ANALYSIS. J. C. Westmoreland. Sept. 26, 1956. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The transient analysis of the Submarine Advanced Reactor steam generators was extended to include the latest geometric constants and refined computer programming. The units will perform adequately under the most severe conditions. (T.R.H.)

2102 KAPL-M-SMS-48
Knolls Atomic Power Lab., Schenectady, N. Y.
PROCEDURE FOR DECONTAMINATION OF PRIMARY

COOLANT SYSTEMS. F. C. Steiner. Dec. 7, 1956. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A procedure is outlined for the removal of deposited crud from a primary coolant system. In addition, the same procedure could be used for the removal of deposited fission products. (L.T.W.)

2103 KAPL-M-SSD-2(Rev. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G COOLANT DISCHARGE SYSTEM DESIGN DESCRIPTION. W. W. Goodwin. Nov. 26, 1956. 17p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The coolant discharge system provides a means of discharging water, resin, and gases overboard from the primary coolant and associated systems. System operation is described, and design drawings are given. (D.E.B.)

2104 KAPL-M-SSD-3(Rev. 3)
Knolls Atomic Power Lab., Schenectady, N. Y.
COO S3G/S4G COOLANT CHARGING SYSTEM DESIGN DESCRIPTION. R. S. Schell. Oct. 31, 1956. Includes Appendix I: DEAERATED FEED. Appendix II: CHEMICAL SHUTDOWN. Appendix III: CORROSION INHIBITING SYSTEM. G. H. Epstein. 57p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90(mf OTS).

The coolant charging system provides a means of introducing pure water, chemical poison, and hydrogen into the primary cooling system. The system consists of the necessary storage tanks, piping, and values for performing these functions. Design specifications and drawings are given. (D.E.B.)

2105 KAPL-M-SSD-8(Rev. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G REACTOR SERVICE AIR SYSTEM DESIGN DESCRIPTION. R. S. Schell. May 8, 1956. 24p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The air service system stores 3000-psi air in a bank of flasks and transmits this air to 40-, 400-, and 2200-psi for normal and emergency reactor operation. Flasks, piping, and reduction valves are described, and the operation of each section of the system is given. (D.E.B.)

2106 KAPL-M-SSD-14(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G CHEMICAL SHUTDOWN SYSTEM DESIGN DESCRIPTION. A. P. Walsh. Mar. 14, 1956. 20p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The chemical shutdown system serves to shutdown the reactor in the event of a partial or complete failure of the control rods by introducing B^{10} in an aqueous solution of ammonium pentaborate. The system consists of a poison cylinder and the necessary valves for operation and protection. (D.E.B.)

2107 KAPL-M-SSD-20(Rev. I)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G CORROSION INHIBITING SYSTEM DESIGN DESCRIPTION. Mar. 12, 1956. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The corrosion inhibiting system adds hydrogen to the coolant; the hydrogen removes dissolved oxygen by a radio-induced combination to form water. The system is designed to maintain an excess of 10 to 20 cc H/kg H_2O. The system consists of hydrogen bottles and the necessary piping and values to introduce the hydrogen into the coolant charging line downstream of the charging pump. Methods for detecting hydrogen leaks, and procedures for normal operation and maintenance are described. (D.E.B.)

2108 KAPL-M-SSD-21
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G PRELIMINARY DESIGN DESCRIPTION EMERGENCY PRESSURIZING SYSTEM. Nov. 15, 1955. 21p., 1 illus. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The emergency pressurizing system is designed to maintain cooling system pressure during periods in which pressurized coolant demands exceed the capacity of the pressurizer. The system consists of a bank of high pressure water flasks and the necessary piping and valves for pressurizing the flasks with air and injecting the water into the charging system. Flasks may be refilled by forcing water through charging system piping or by loading charging water storage tanks with low pressure air. Design specifications and drawings and performance characteristics are given. (D.E.B.)

2109 KAPL-M-SSD-23(Rev.2)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G NUCLEAR INSTRUMENTATION SYSTEM. V. B. Scoville. May 22, 1956. 28p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The nuclear instrumentation system must monitor nuclear conditions in the reactor, indicate power level and period for startup and operation, and provide control signals for the reactor protective system. The instrumentation system consists of radiation detectors and their associated electronic equipment and indicators. A detailed design description is given. (D.E.B.)

2110 KAPL-M-SSD-24(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
PRELIMINARY SYSTEM DESCRIPTION—S3G SPECIAL INSTRUMENTATION SYSTEM. F. E. Ackley, R. E. Duncklee, and R. K. Van Schaack. Oct. 24, 1956. 42p. Contract W-31-109-Eng-52. $12.30(ph OTS); $4.50(mf OTS).

A design description of the Submarine Advanced Reactor (S3G) special instrumentation system is given. This description is confined to the special instrumentation which will be used to record and monitor the performance of the S3G plant and its components. (L.T.W.)

2111 KAPL-M-SSD-26(Rev. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G COOLANT SAMPLING SYSTEM DESIGN DESCRIPTION. F. C. Steiner. Oct. 2, 1956. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The coolant sampling system is designed to permit primary coolant sampling for radioactivity, argon, hydrogen, and total gas. Procedures for sampling and analysis are given as well as a detailed system design description. (D.E.B.)

2112 KAPL-M-SSD-35(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G IN-HULL REACTOR REFUELING AND SERVICE SYSTEM DESCRIPTION. B. B. Scott. Aug. 3, 1956. 102p. Contract W-31-109-Eng-52. $16.80(ph OTS); $5.70(mf OTS).

Equipment and procedures developed for in-hull control element maintenance, fuel element replacement, and complete fuel loading in the Submarine Advanced Reactor are presented. (D.E.B.)

2113 KAPL-M-SSD-38
Knolls Atomic Power Lab., Schenectady, N. Y.
OFF-HULL REACTOR SERVICE SYSTEM FOR S4G SYSTEM DESCRIPTION. Sub Task 16.4. F. W. Kunz. Sept. 4, 1956. 50p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

The off-hull reactor service system provides a means of receiving, storing, and transporting spent fuel and is designed to perform all other off-hull tasks coincidental with the refueling, replacement, and maintenance of the reactor. (D.E.B.)

2114 KAPL-M-SSD-39(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G FULL-SCALE REFUELING MOCKUP SYSTEM DESCRIPTION. D. E. Nolte. Aug. 22, 1956. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

2115 KAPL-M-SSD-41(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G MAIN COOLANT PUMP VIBRATION MONITORING SYSTEM PRELIMINARY DESIGN DESCRIPTION. V. B. Scoville. Oct. 31, 1956. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

This system detects mechanical vibrations in the main coolant pumps, indicates the vibration level, actuates an alarm when vibration becomes excessive, and provides a facility for audible vibration monitoring. (D.E.B.)

2116 KAPL-M-SSD-44
Knolls Atomic Power Lab., Schenectady, N. Y.
SYSTEMS DESCRIPTION—S3G CORE COOLANT FLOW MEASURING SYSTEM. H. Paitchel. Oct. 24, 1956. 16p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The described system provides measurements of flow through specified rhombus channels in the Submarine Advanced Reactor. Measurements are made by placing pitot tubes in the channels, hydraulically transmitting differential pressure signals to transducers, converting these signals into force signals, and then into electrical signals suitable for recording. Design specifications and drawings are given. (D.E.B.)

2117 KLX-1604
Vitro Corp. of America, New York.
HOMOGENEOUS REACTOR PROCESSING PROGRESS REPORT FOR AUGUST. JOB 57. Sept. 9, 1952. Decl. Mar. 25, 1957. 30p. Contract AT(11-1)-217. $6.30(ph OTS); $3.00(mf OTS).

The development of an economical method for recovering D_2O solvent from spent homogeneous reactor UO_2SO_4 fuel solution is presented. A study was made to determine the feasibility and economics of ion exchange separation of fission products from UO_2SO_4 solutions for comparison with alternate decontamination processes. A general program to develop the most economical method for conversion of pure UF_6 to pure UO_2SO_4 in D_2O solution is outlined. (J.E.D.)

2118 KLX-10006
Vitro Labs., West Orange, N. J.
HOMOGENEOUS REACTOR FUEL REPROCESSING, QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1955. JOB 1087. Harold F. Reichard, John D. McAdoo, Stanley J. Klach, and Gloria K. Koenig. July 29, 1955. Decl. Feb. 28, 1957. 15p. [For Oak Ridge National Lab.] Contract W-7405-Eng-26, Subcontract No. 535. $3.30 (ph OTS); $2.40(mf OTS).

Laboratory studies were continued on the high-temperature kinetics of iodine removal from simulated fuel solutions, by adding a tagged solution of I to a UO_2SO_4 solution containing Cu_2SO_4 and H_2SO_4 at 270 to 280°C in a quartz-lined stainless steel bomb containing a silver adsorber. The effect of stainless steel on I behavior was investigated in a blank run without the silver adsorber. Conceptual flowsheets are given of an iodine processing cycle for a full scale reactor based on iodine separation by gas-stripping of the elecmental form, using D_2O vapor or non-condensable gas. A batch test was made to determine the reduction in solubility of $Ce_2(SO_4)_3$ by the presence of garnet sand in contract with a simulated fuel solution at 300°C. (T.R.H.)

2119 LA-1648
Los Alamos Scientific Lab., N. Mex.
A HAZARDS SUMMARY FOR THE PROPOSED LOS ALAMOS OMEGA WEST REACTOR. E. T. Jurney. Feb. 1954. Decl. Apr. 1, 1957. 41p. Contract W-7405-eng-36. $0.35(OTS).

The proposed Los Alamos Omega West Reactor is designed to be a research tool delivering a maximum neutron flux of approximately 5×10^{13} n/sec/cm^2 at its maximum operating power level of 5 megawatts. Solid fuel elements of the type developed for the Materials Testing Reactor will be utilized. Cooling will be accomplished with circulating demineralized water and evaporative coolers. Experimental facilities will include numerous horizontal ports, two of which will incorporate built-in rotary beam shutters, and a thermal column. If all the radioactive material contained in the fuel elements during normal reactor operation were to become spread through the residential area of Los Alamos, persons in some parts of the city would be exposed to greater than lethal doses. It does not appear that known mechanisms could operate to produce this situation. Because of geographical relationships and low ground-water flow velocities, there seems to be no likelihood of water supply contamination in the event of a reactor disaster. Care has been taken in the reactor design to insure against sudden draining of the main reactor tank containing the fuel assembly, as such a sudden loss in cooling might lead to damage of the fuel elements. Conservative estimates indicate that the reactor shielding is adequate for the protection of the operating personnel. (auth)

2120 LA-1724
Los Alamos Scientific Lab. N. Mex.
AN ESTIMATE OF THE LAPRE POWER AND STEAM FLOW CHARACTERISTICS. Franklin P. Durham. Aug. 1954. Decl. Apr. 2, 1957. 27p. Contract W-7405-eng-36. $0.30(OTS).

A method of numerical solution is developed for calculating the LAPRE (Los Alamos Power Reactor Experiment) coolant pressure drop and power output with variable coolant inlet pressure, flow rate, and reactor solution temperature. The results of a series of calculations are presented that show excessive pressure drops and sonic exit flow as the flow rate is increased and the inlet pressure is decreased. Both supercritical and subcritical coolant flow regions are investigated. Reactor power is shown to be strongly dependent on the solution temperature in the region of 700 to 750°F. At the design flow of 12 gal/min, excessive coolant pressure drops are encountered at inlet pressures of 2000 lb/in.^{2} and below. (auth)

2121 LA-2023
Los Alamos Scientific Lab., N. Mex.
PRELIMINARY SURVEY OF URANIUM METAL EXPONENTIAL COLUMNS. J. J. Neuer, C. B. Stewart, G. A. Jarvis, R. N. Olcott, D. S. Young, and J. E. Sattizahn. Jan. 1956. Decl. Apr. 2, 1957. 44p. Contract W-7405-eng-36. $7.80(ph OTS); $3.30(mf OTS).

Reflected cylindrical exponential columns of bare and natural U were constructed of stacked plates of oralloy (93.4%) and tubalioy. Average concentrations of U^{235} ranging from 0.72% to 9.18% were investigated. Flux distributions, buckling values, and spectral indices were obtained. The indicated U^{235} concentration for infinite critical mass is about 5.5%. (auth)

2122 LRL-68(Del.)
California Research & Development Co. Livermore Research Lab., Livermore, Calif.

PLUTONIUM FAST POWER BREEDER REACTOR STUDY. H. A. Brammer. Dec. 1953. Decl. with deletions Feb. 27, 1957. 61p. Contract AT(11-1)-74. $9.30(ph OTS); $3.60(mf OTS).

Preliminary nuclear physics calculations are made on several reactor systems to determine a feasible configuration for a Pu fast power breeder reactor, with particular emphasis on achieving positive breeding gain, high specific power, and good over-all efficiency of the system. Non-blanket reactors of both single fuel pass (once-through) and fuel recycle types are investigated, but none of the systems calculated appears to be practical from the standpoint of critical mass requirements. Blanketed reactor calculations however, indicate that this type of system offers a feasible approach to the power breeder reactor problem. (auth)

2123 NAA-SR-31(Del.)
North American Aviation, Inc., Los Angeles.
A STUDY OF REACTOR HAZARDS. M. M. Mills. Dec. 7, 1949. Decl. with deletions Jan. 17, 1957. 149p. Contract AT-11-1-GEN-8. $0.70(OTS).

A major public hazard associated with any nuclear reactor is the possible contamination of the atmosphere or water supply by the accidental release of the radioactive products of reactor operation. This problem can be considered in two stages; namely, (1) the technological sequence of events leading to the hazardous release of radioactive products from the reactor, and (2) the distribution of such released products by meteorological and hydrological mechanisms. This report considers the first problem and contains detailed technical analysis of the sequence of events leading to the destructive runaway of the reactor following the release of a large amount of excess reactivity. The results of the study of a number of existing reactors indicates that the mechanical violence associated with reactor runaway is not very great and that the chemical reactions and similar secondary reactions are usually a more serious source of disruptive energy than the runaway nuclear reaction. In practically every case it appears that the end result of a reactor runaway is the gradual (non-explosive) release of volatilized substances containing radioactive products, and the quantity so released is usually small enough to be contained within an adequately sealed building. The elements of design which can significantly increase the safety of any reactor are discussed. In particular the parameters leading to large, negative, transient temperature and power coefficients are reviewed. A reactor design intrinsically safe against runaway is described and analyzed in detail. (auth)

2124 NAA-SR-91
North American Aviation, Inc., Downey, Calif.
DISTRIBUTION OF FEED MATERIAL IN PRODUCTION REACTORS. S. H. Browne and W. J. Houghton. Apr. 26, 1954. Decl. Apr. 10, 1957. 40p. Contract AT-11-1-GEN-2. $0.35(OTS).

The problem of finding the optimum distribution for the producer material in a reactor which produces special isotopes involves many aspects of reactor design. This report considers the effect of the neutron economy on the desired distribution. The resulting general equations are derived on the basis of one- and two-group diffusion theories. The specific cases investigated in more detail are those of a one dimensional reactor with uniformly spaced producer material slabs in the core and/or reflector. An equivalence formula is presented relating the absorption of a slab to that of a uniform parallel array of rods. (auth)

2125 NAA-SR-94(Del.)
North American Aviation, Inc., Downey, Calif.
CORROSION PROBLEMS IN THE NPR. R. L. Loftness and M. H. Feldman. [1951]. Decl. with deletions Feb. 27, 1957. 38p. Contract AT-11-1-GEN-8. $6.30(ph OTS); $3.00(mf OTS).

General concepts of corrosion and the available data on aluminum and stainless steel corrosion by water are summarized Study of the aluminum–water system includes consideration of several alloy types, and of the influence of water temperature, flow rate, pH and dissolved material. The wide variance in reported values allows only tentative interpolation in a considerable region of possible operating temperatures. At 135°C, the corrosion rate of type 2S aluminum is estimated at a maximum of 1.0 mils/month in the process water proposed, with the range 0.01 to 0.5 mils/month representing probable mean values. Possible ways of minimizing corrosion, such as anodizing and the use of inhibitors, are discussed. Corrosion of stainless steel is shown to be negligible. The effect of corrosion and film formation on heat transfer is briefly considered. (auth)

2126 NAA-SR-129(Del.)
North American Aviation, Inc., Downey, Calif.
CONTROL REQUIREMENTS FOR THE NAA-NPR. M. A. Greenfield. June 29, 1951. Decl. with deletions Mar. 4, 1957. 23p. Contract AT-11-1-GEN-8. $4.80(ph OTS); $2.70(mf OTS).

Calculations are given for the number and size of control rods to be used with the neutron-production reactor described in NAA-SR-61. The computations are based on a two-energy group model. Numerical results are given in the form of a graph of Δk plotted as a function of the area controlled per rod. (auth)

2127 NAA-SR-155
North American Aviation, Inc., Downey, Calif.
THERMAL NEUTRON FLUX IN A LATTICE CELL. E. R. Cohen. Nov. 23, 1951. Decl. Mar. 28, 1957. 23p. Contract AT-11-1-GEN-8. $0.30(OTS).

The distribution of neutrons in the moderator of an infinite square-lattice array is found, assuming diffusion theory and a uniform production of neutrons throughout the moderator. The variation of neutron flux density along the sides of a lattice cell is shown to be significant. In spite of this, the thermal utilization of the lattice can be quite accurately calculated by the use of a "cylindricalized" cell. The absorption of neutrons by the moderator is shown to have an effect on the flux distribution which is negligible if the cell spacing is smaller than the thermal diffusion length of the moderator. (auth)

2128 NAA-SR-Memo-107(Del.)
North American Aviation, Inc., Downey, Calif.
PROGRESS REPORT FOR [THE] MONTH OF AUGUST 1951. Oct. 16, 1951. Decl. with deletions Feb. 27, 1957. 22p. Contract AT-11-1-GEN-8. $4.80(ph OTS); $2.70 (mf OTS).

Design studies were continued on the optimized Pu power reactor. The performance study of reactor configurations for a high-temperature power plant was continued with emphasis on breeding systems. Reactor specifications are listed. Data are included on fission product diffusion from impregnated graphite. Component development for the Low Power Research Reactor was continued with emphasis on the fuel element. Fuel block impregnation techniques are briefly discussed. Radiation effects in graphite and metals are summarized. The status of the MTA program is reviewed. (B.J.H.)

2129 NAA-SR-Memo-278
North American Aviation, Inc., [Downey, Calif.]
CRITICALITY PROCEDURE AND HAZARDS ASSOCIATED WITH THE NORTH AMERICAN AVIATION WATER BOILER NEUTRON SOURCE. A. T. Biehl. APP. A. VISIT TO LOS ALAMOS CONCERNING WATER BOILER. APP. B. FLUX

DISTRIBUTION IN WATER BOILER PEDESTAL. APP. C. FLUX VALUES AND DISTRIBUTION IN WBNS. APP. D. WBNS CONTROL SYSTEM. APP. E. WATER BOILER CRITICAL MASS CALCULATIONS I. APP. F. WBNS CRITICAL EXPERIMENT. APP. G. EXPECTED SOLUTION ACTIVITY. APP. H. EFFECT OF AMBIENT TEMPERATURE ON H_2O BOILER. APP. I. SHIELD FOR WATER. APP. J. THE EFFECT OF STEP INCREASES IN REACTIVITY. APP. K. CATALYTIC RECOMBINER FOR NAA WATER BOILER. A. T. Biehl, E. R. Cohen, D. Howard, E. Weisner, G. Steel, R. Balent, and J. B. Chrisney. Mar. 28, 1952. Decl. Feb. 28, 1957. 57p. $25.80(ph OTS); $7.80(mf OTS).

The design, proposed operation, and criticality procedure for the NAA Water Boiler Neutron Source are described in detail, with particular emphasis on the potential hazards involved in startup and normal operations. (auth)

2130 NAA-SR-Memo-542

North American Aviation, Inc., Downey, Calif.

THE EFFECT OF NEUTRON VELOCITY DISTRIBUTION ON ETA. L. B. Robinson. Dec. 17, 1952. Decl. Mar. 28, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

In performing criticality calculations for the UPR, it has become necessary to examine the basis for the determination of the usual four factors η, f, p, and ϵ. A procedure for the calculation of η is suggested. The principal effect considered is that of the distribution of neutron speeds. Some background material is included as well as a justification of the procedure. Inherent in the procedure is the assumption that all contributions to η result from thermal neutrons. (auth)

2131 NAA-SR-Memo-721

North American Aviation, Inc., [Downey, Calif.].

EXCESS REACTIVITY AVAILABLE AND CONTROL REQUIREMENTS OF THE PLUTONIUM PRODUCTION UPR CORE. Ralph Balent. June 18, 1953. Decl. Feb. 27, 1957. 18p. $4.80(ph OTS); $2.70(mf OTS).

The excess reactivity available in the plutonium production core of the Uranium Production Reactor is shown to be 5.2%. A total of 24 cadmium rods will control 7.15% reactivity which leaves 6 rods or approximately 2% reactivity for safety at all times. The control requirements of the plutonium production core are given. The difference between control requirements and that available can be, considered as a margin of safety and will permit a certain amount of operational flexibility. (auth)

2132 NEA-5301(Del.)

Foster Wheeler Corp., New York and Pioneer Service and Engineering Co., Chicago.

A SURVEY OF REACTOR SYSTEMS FOR CENTRAL STATION POWER GENERATION. C. R. Barthelemy, V. H. Simon, D. M. Leppke, and Theodore Stern. Oct. 1953. Decl. with deletions Mar. 28, 1957. 262p. $41.40(ph OTS); $11.10(mf OTS).

This report presents the results of a survey of the technical and economic feasibility of existing and proposed reactor designs which might be used for central-station power generation. The report consists of a technical summarization of the design features of the reactors studied, an economic analysis of those reactor systems to which available cost data could be applied, and an engineering evaluation of the most promising types. The Appendix contains the detailed analysis. The survey concludes that nuclear reactor technology has progressed to a stage where it is technically feasible to construct and operate a nuclear reactor for central-station power generation with only a limited amount of pilot plant and component testing. None of the reactor systems studied can produce economic central-station power today. The two reactor types that offer the greatest possibilities for economic production of central-station power are the thermal, U^{233} breeders of the circulating fuel type, and fast plutonium breeders containing fuel easily adaptable to a simple processing system. Given the opportunity, the Companies would study first a version of the circulating fuel thermal breeder, namely, a fluidized solids reactor, and then would re-evaluate other circulating fuel thermal breeders and fast breeders. (auth)

2133 NPG-112

Nuclear Power Group, Chicago.

PRELIMINARY DESIGN AND COST ESTIMATE FOR THE PRODUCTION OF CENTRAL STATION POWER FROM AN AQUEOUS HOMOGENEOUS REACTOR UTILIZING THORIUM–URANIUM-233. H. G. Carson and L. H. Landrum, eds. Feb. 1, 1955. Decl. May 8, 1957. 138p. $0.80(OTS).

The design and economics of the Aqueous Homogeneous Reactor as basically under development at the Oak Ridge National Laboratory are presented. The reactor system utilizes thorium-U-233 fuel. Conditions accompanying reactor systems generating up to 1080 mw of net electrical energy are covered. The study indicates that a generating station, with a net thermal efficiency of 28.1%, might be constructed for approximately $240/kw and $200/kw at the 180 mw and 1080 mw electrical levels, respectively. These values result in capital expenses of approximately 4.72 and 2.86 mills/kwh. A major part of fuel cost is the expense of chemical processing. It is therefore advantageous to schedule fuel through a relatively large processing system since fixed charges are insensitive to chemical plant size. By handling fuel through a plant large enough for processing 200 kg of thorium per day, total fuel costs of about 1 mill/kwh result. This cost for fuel processing appears applicable to generating stations up to about 540 mw in size, decreasing to about 0.6 mills/kwh at the 1080 mw level. Operating and maintenance expense, including heavy water cost on a lease basis, varies between 1.34 and 0.89 mills/kwh for 180 and 1080 megawatts respectively. If the purchase of heavy water is required, 0.3 to 0.4 mills/kwh must be added. It is concluded that the Aqueous Homogeneous Reactor may produce electrical power competitive with conventional generating systems when the remaining technical problems are solved. It is felt that the research and development now programmed by the Oak Ridge National Laboratory will solve these problems and affect costs favorably. (auth)

2134 ORNL-925

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR EXPERIMENT. Quarterly Progress Report for Period Ending November 30, 1950. C. E. Winters and C. H. Secoy, eds. Jan. 30, 1951. Decl. Mar. 2, 1957. 317p. Contract W-7405-eng-26. $55.10(ph OTS); $11.10(mf OTS).

The HRE process flow diagram is given, as are diagrams of the tank assembly, the recombiner assembly, and the air flow system. Calculations and preliminary design work are also discussed. Data are given on control and simulator design for the HRE. A detailed evaluation was made of the thermal neutron absorption in the reactor. Data are also given induced activity in stainless steel, steel, and barytes concrete. Self shielding data are given for various reactor components. The dynamics of the HRE were analyzed, and data are given in graphical form. The simulator was used to obtain data on the effect of a step function in reactivity. The general equations of motion of the reactor are given. Corrosion studies include studies of protective treatments for stainless steels, corrosion resistance of stainless steels,

Zr, and reflector materials, and corrosion in uranyl sulfate systems. Radiation stability and in-pile corrosion tests are described. Results of the tests are briefly summarized. Pictorial results of the work done on induction methods of soldering and of pretreated and corrosion-tested stainless steel are included. Studies of the recombination of H and O are summarized. Pilot tests of recombiners are discussed. Data are included on the solubility of fission product sulfates at high temperatures and pressures. Methods for the analytical chemical control of the homogeneous reactor solution are discussed. A study of the properties of the thorium nitrate–water system was completed. Data are given on the behavior of uranium slurries. Methods of the continuous removal of fission products from homogeneous reactor solutions are discussed. (D.E.B.)

2135 ORNL-1424(Del.)
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 1, 1952. W. E. Thompson, comp. Jan. 10, 1953. Decl. with deletions Mar. 5, 1957. 139p. Contract W-7405-eng-26. $21.30(ph OTS); $6.90(mf OTS).

Progress is reported on the following studies: temperature coefficients of reactivity of HRE core and reflector, HRE inhour curves, engineering studies of reactor components, boiling reactor research (nuclear stability, power removal, Boiling Reactor experiment design), slurry fuel studies (UO_3 chemistry, radiation chemistry, corrosion studies, slurry boiling studies, pumping studies), Intermediate Scale Homogeneous Reactor Design (equipment layouts, heat exchanger, poisoning, heavy isotope buildup, core design), radiation chemistry (long term irradiations at high temperature and high flux, catalysis in H_2O_2 decomposition, catalytic recombination of H_2 and O_2), solution chemistry (vapor pressure of UO_2SO_4 solutions, solubility of UO_3 in UO_2SO_4 and UO_2F_2 solutions, system $UO_2SO_4-H_2SO_4-H_2O$, corrosion inhibitors), and metallurgy of Ti. (W.L.H.)

2136 ORNL-1915(Del.)
Oak Ridge National Lab., Tenn.
INVESTIGATION OF MATERIALS FOR A WATER COOLED AND MODERATED REACTOR. Louis Scheib. Aug. 1954. Decl. with deletions May 8, 1957. 169p. Contract W-7405-eng-26. $25.80(ph OTS); $7.80(mf OTS).

An investigation of the materials for use in the water-moderated and cooled Army Package Power Reactor (APPR) operating at about 500°F was made. The available literature was analyzed, and the results of the different investigators were compared and averaged. Twenty different materials, including stainless steels, nickel alloys, Stellites and others, were investigated from the point of view of physical properties, susceptibility to radiation damage, and corrosion resistance. Corrosion rates were established for all the materials under various conditions, such as irradiation, flow, weld, stress, and various water conditions. Type-304 stainless steel was selected as the basic structural material. Operating conditions, to maintain minimum corrosion, were established also. (auth)

2137 ORNL-2004(Del.)
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1955. H. F. McDuffie and V. K. Hill, comps. Jan. 31, 1956. Decl. with deletions Feb. 25, 1957. 228p. Contract W-7405-eng-26. $1.25(OTS).

Homogeneous Reactor Test. The status of construction and design is discussed. Schematic diagrams are given for a closed cooling-water circuit for the thermal shield which will maintain the temperature of the shielding material below 180°F. Final designs are shown for the blast shield, consisting of a 1-in. carbon steel shell, for the HRT steam generator. Calculations on freeze units were made, and data on refrigeration loads are summarized. The dissociation of D_2O in storage tanks is discussed. Designs of the HRT leak detection system are also given. A pressure test of the shield tank was made, showing that it is capable of containing a uniform gas pressure of 30 psig. Tests of Westinghouse canned-rotor pumps were continued. Photographs of pump corrosion are shown. The operation of other reactor components is briefly discussed. Designs are shown for the differential pressure transmitter which is the sensing element for balancing the pressure between the reactor core and the blanket systems. Designs for low- and high-pressure valves are also given. Designs and flowsheets are given for the experimental HRT fuel-processing plant designed to remove the insoluble fission and corrosion products from 0.25 to 1 gpm of reactor fuel bypassing the heat exchanger. Operation characteristics of the plant are also discussed. Reactor Design and Analysis. A design study is made of the Thorium Breeder Reactor. Included are tables of TBR reduced-power operating conditions and TBR pilot-plant reactor and design parameters. Several possible incidents involving interruption of normal operation of the TBR were investigated. These include cessation of heat removal, interruption of fuel flow, circulating pump failure, and steam-pressure decrease. In order to evaluate the reactor safety, parameters for various reactors were studied and discussed. Data are summarized on the effect of Li_2SO_4 on the fuel cost of a Pu-producing power reactor. Results indicate that addition in the same molar concentration adds about 0.8 mill/kwhr to the fuel cost near the optimum U concentration. Breeding ratios and fuel removal for one- and two-region reactors are discussed. Engineering Development. A low-pressure natural-circulation catalytic recombiner was designed and fabricated, and tests indicate the feasibility of the design. Tests were continued on the Westinghouse 200 A slurry pump. Flow diagrams are shown for several promising dump tank systems. Transport velocities at room temperature for ThO_2 slurries in $\frac{3}{4}$-in. glass pipe are summarized. Corrosion and Materials. The operation and maintenance of the dynamic corrosion test loops are discussed. Complete data are tabulated on the corrosion rates of pin-type corrosion specimens in UO_2SO_4 solutions. The weight changes and corrosion rates of type 347 stainless steel in simulated HRT solutions are also given. The stability of uranyl sulfate solutions is discussed. The corrosion behavior of stainless steel high-pressure valves was examined in nonaerated sulfuric acid and uranyl sulfate solutions at room temperatures. The corrosion of cast Zr alloys by oxygenated UO_2SO_4 solutions at 300°C was also studied. A schematic diagram is given of the slurry corrosion loop. The resultant corrosion data are tabulated. The static and dynamic toroid loop corrosion on 54S Al at 200°C are summarized. Design, development, and construction of radiation corrosion loops are discussed. The results of solution analyses for constituents other than irradiation products are summarized. Results of oxygen depletion measurements are also shown. Data on induced Zr–Nb and Cr activity in irradiated specimens are tabulated. Corrosion rates of Zircaloy-2 specimens are plotted as a function of the fission power density to which they are exposed. Further studies on the effect of reactor radiation on the corrosion of Zircaloy-2 by UO_2SO_4 solutions were conducted in the LITR. Data are summarized for both the LITR and the MTR bomb experiments. Data are presented

on the mean linear coefficient of thermal expansion of Zircaloy-2 plate as a function of rolling direction. A comparison was made of the structure of welds made with A and N as backup gases. Procedures for the welding of Ti–carbon steel composites are discussed. The nature of zirconium oxide films is discussed. Data are tabulated on the variation in impact energy with testing temperature for irradiated Zircaloy-2 specimens. The closure joint in the HRT pressure vessel is described in detail. Chemical Engineering Development. Development of a thorium oxide slurry for use in the blanket of the HRT was continued. A summary of data on irradiated slurries was given. Other properties of thorium oxide preparations are discussed. The characteristics of pyrohydrolyzed ThO_2 are summarized. The effects of the oxide preparation method on various properties of ThO_2 are also discussed. Data on other properties are also given. The viscosity of ThO_2 slurry at elevated temperatures was studied. Pumping and viscosity data on these slurries are also tabulated. Rare earth sulfate precipitation from fuel solution was studied. Methods for processing the UO_2SO_4 blanket of the Pu producer are discussed. Studies of Pu chemistry include the adsorption of Pu on metals, the separation of PuO_2 by a hydroclone, and in-pile studies. The leaching of Pu from irradiated ThO_2 is discussed. Processes for the removal of scale from stainless steel were discussed. The work of the Vitro laboratories is summarized. Supporting Chemical Research. Investigation of alkaline carbonate–uranium trioxide systems at 250°C was continued. The oxidation of chromic(III) hydroxide at 250°C was also studied. The cation-exchange properties of zirconium phosphate and zirconium tungstate and the anion-exchange properties of zirconium hydroxide were studied. Brief analyses are given on UO_2SO_4 solutions, ThO_2, and the off gases from dynamic loop tests. (C.H.)

2138 ORNL-2057 (Del.)
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1956. H. F. McDuffie, and V. K. Hill, comps. Apr. 17, 1956. Decl. with deletions Feb. 25, 1957. 142p. Contract W-7405-eng-26. $0.75(OTS).

Homogeneous Reactor Test. Progress on the installation of reactor parts at the installation site is summarized. Testing of the fuel low-pressure dump-tank assembly installed in its outdoor test stand was completed. The design finally developed for the Zircaloy-to-stainless steel joint is shown. The HRT steam pressurizer was redesigned to eliminate contact of uranyl sulfate with heated surfaces. Designs are given for a system to add oxygen to the HRT fuel systems. The revised waste evaporator system is shown. Typical low-pressure valve installations are also shown. Barytes aggregate-water placement tests are described, and the lateral pressure of the mixtures is given in graphical form. HRT pump development is discussed. Analytical results of HRT heat exchanger cleaning are given. The flowsheet of the mockup in its present state is shown. Data are given from chemical analyses of HRT mockup fuel during gas- and steam-pressurization runs. Pressure rises following stoppage of heat removal in the HRT are shown for various discharge rates. With no fluid discharge the pressure would reach 2800 psia in 38 sec, and continue to rise until some safety device was actuated. The pressure-time relation during an HRT dump was calculated for various combinations of heat generation, heat removal, and venting conditions, and complete results are given. Two prototype pressurizer-level controllers, incorporating hydraulic and magnetic damping systems, are shown. A prototype model of the dump-valve operator is shown and was cycled 20,000 times without failure. Plans for the HRT fuel processing building are shown and discussed. The predicted solids production in the HRT is tabulated. More detailed descriptions are given of the fuel processing systems, such as the high-pressure system, the underflow pot cooling system, the low-pressure system, the off-gas disposal system, the U recovery system, and the fuel addition system. Diagrams of the various systems are given, and data are included on the two-liquid-phase region of UO_2SO_4 in H_2O and D_2O, solids concentration in circulating reactor fuel as a function of hydroclone operating time, temperatures of the underflow-pot system during a heating cycle, and the rate of decomposition of D_2O in the evaporator decay tank. Reactor Design and Analysis. A study of fuel costs was made for power-only reactor systems fueled by $UO_2SO_4–Li_2SO_4–D_2O$ solutions. The effects of U concentration and diameter on fuel cost are shown. The optimum U concentration was about 200 g/liter, and the optimum diameter is approximately 14 ft. Results for several reactors near optimum conditions are listed. Critical concentrations and breeding ratios were calculated for a series of D_2O-moderated Th breeder reactors, and results are given in graphical form. Reactivity changes associated with slurry settling in the TBR are given. Engineering Development. Model III of the high-pressure recombiner loop is shown. Other recombiner developments are discussed. The attack of circulating aqueous ThO_2 slurries on stainless steel systems was studied, and results are tabulated. The use of Westinghouse slurry pump 200A is discussed. Designs are shown for a conical dump tank with a vertical gas lift. Corrosion and Materials. Corrosion in pump loops and toroids is discussed. Thorium oxide slurry corrosion of pump loops is also discussed. Comparative corrosion rates of various materials by circulating thorium oxide slurry at 300°C are tabulated. In-pile loops for radiation corrosion tests are described. Investigations of the effect of radiation on the corrosion of Zircaloy-2 and type 347 stainless steel were continued, and complete results are tabulated. Data on the corrosion of stainless steel at 250°C in UO_2SO_4 solution are also given. Metallographic examination of several specimens have been made to provide information on basic mechanisms in the Zr–H system. The structure of Zircaloy-2 was also studied. Variations in the time-to-failure in stress-corrosion testing of stainless steels are tabulated. Chemical Engineering Development. Thorium oxide slurry irradiation studies were continued, and radiation effects are summarized. Viscosities of thorium oxide slurries are also tabulated. The characteristic properties of Th–U mixed oxides are listed. The combination rates of stoichiometric H and O mixtures in thorium oxide slurries containing various catalysts were determined. The effect of pumping at 250°C for 100 hr in the 5 gpm loops upon the average crystallite size, sedimentation particle-size distribution, hindered-settling rate, and settled concentration of 3 thorium oxide preparations was determined. The effects of firing time, temperature, and pumping on the growth of ThO_2 crystallites are shown. The effect of H_2SO_4 on the settling properties of ThO_2 slurries was also determined. Other properties of various thorium oxides and their slurries are listed. Developments in fission- and corrosion-product chemistry are summarized. The rates of Pu adsorption of Zircaloy-2 and Ti are given for various temperatures. Strong inorganic reducing agents were tested for removal of oxide film and Pu from type 347 stainless steel, Ti, and Zircaloy-2. Supporting Chemical Research. Phase diagrams are given for the $Li_2O–UO_3–CO_3–H_2O$ system, and data are given on the solubility of Li_2CO_3. The uptake of Cs on zirconium tung-

state was studied. Protactinium chemistry is also discussed. (C.H.)

2139 ORNL-2148(Del.)
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1956. Oct. 3, 1956. Decl. with deletions Feb. 25, 1957. 158p. Contract W-7405-eng-26. $0.75(OTS).

Homogeneous Reactor Test. Experiments and tests conducted preparatory to operation with unenriched UO_2SO_4 are reviewed. Remote maintenance practices and operation at reduced pressures and temperatures were analyzed. A simplified freeze jacket design for remote operation will be used in the HRT system. A differential-temperature flowmeter was designed for use on feed and purge pumps. The preliminary design of the replacement pressure vessel is shown. Fuel and blanket feed and purge pump test using UO_2SO_4 solutions were continued. Performance and corrosion results are given. HRT controls and instrumentation status is reviewed. Flowsheets for the fuel and blanket chemical processing systems are shown. The construction and engineering test status of the fuel processing plant are presented. Reactor Design and Analysis. Preliminary design parameters indicate the feasibility of a 500 Mw homogeneous research reactor using UO_2SO_4. The fuel costs for homogeneous reactors whose fuel is processed on a batch rather than a continuous basis were analyzed. Tables of data were prepared indicating the effects of fuel isotopic concentration, the use of Li_2SO_4 additives, fission product removal, reactor operating periods, and Pu recovery on per kw power cost. The effects of Xe^{135} on reactor conditions following shutdown were determined for the case of a $U^{238}O_2SO_4$, D_2O, spherical reactor operating at 280°C, assuming no fission product removal. Engineering Development. Developmental studies of ThO_2 blanket slurries were continued. Experience with ThO_2 deposits in circulation loops is tabulated; and shear diagrams, friction factors, and heat transfer characteristics are plotted. Slurry blanket system operational tests indicate satisfactory operation up to 300°C. Corrosion and Materials. Studies of the corrosive effects of UO_2SO_4 on Zircaloy, stainless steel, and Al_2O_3 were continued. The appearance of liquid phases as a function of temperature in $UO_2SO_4-Li_2SO_4$, $UO_2SO_4-BeSO_4$, and $BeSO_4-UO_3$ systems is plotted. Additional observations of pump corrosion and performance in reactor blanket loops containing a range of ThO_2 concentrations are reported. Further attempts were made to establish the effects of slurry particle size on corrosive attack rates. Results of metallographic examinations of in-pile corrosion specimens of Zr and Ti alloys and stainless steel are tabulated and discussed. The effects of high temperatures and welding on crystalline phase changes in Zr alloys were investigated. The crystalline phase changes in H pickup in Ti, Zr, Al–Ti–V alloy, and Zircaloy upon exposure in the recombiner loop were determined. The effects of aging and temperature on Zircaloy impact strength are plotted. Chemical Engineering Development. Chemical and engineering studies associated with HRT fuel processing are reported. In the study of Pu-producer blanket chemistry, adsorption of Pu on metals, Pu behavior in UO_2SO_4 solutions at 250°C, and dissolution of corrosion product oxides were considered. Slurries of $ThO_2-UO_3-MoO_3-H_2O$ were prepared and irradiated. Radiation effects and gas recombination rates for this type slurry are reported. Methods of particle size control in Th and U oxide preparation, and the effects of additives on oxide sedimentation rates in slurries were investigated. Supporting Chemical Research. Studies of slurry particle preparation and suspension are reported. The methods used in separating Pa^{231} from Mallinckrodt waste are reviewed. (D.E.B.)

2140 TID-10092
Clinton National Lab., Oak Ridge, Tenn.
THE HOMOGENEOUS NATURAL URANIUM–D_2O PILE AS A SOURCE OF POWER. THE EFFECT OF HEAVY ISOTOPE BUILD-UP ON THE CRITICAL VOLUME AND BREEDING POSSIBILITIES. H. C. Ott. Jan. 14, 1948. Decl. Mar. 7, 1957. 53p. Contract W-35-058-eng-71. $0.40(OTS).

The volume of the critical sphere with various ratios of moderator to U were re-calculated, using the most recent values of the constants involved. This showed a minimum volume of 19 m^3 reactor volume for a ratio of ~80 mols D_2O per atom of U^{238}. This would require ~21 metric tons of D_2O and 3.12 metric tons of U at a concentration of 0.164 g/cc (0.186 g/cc of UO_2). Starting with a pile of this size and concentration the effect of heavy isotope build-up as a function of φt was studied. It was found that after remaining nearly constant (or increasing slightly) for a short time, the required critical volume would decrease to a minimum of 17.5 m^3 after an elapsed φt (average thermal flux x days) of ~10^{16} and thereafter rise to very large values. At the same time g_{int} (fissile atoms created in reactor/fissile atoms destroyed) varied from an initial value of 0.89 through a minimum of 0.86 and then rose to a value near unity. (auth)

2141 WAPD-108
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
MULTIGROUP, INTEGRAL NETWORK METHOD. Daniel Schiff. July 1954. Decl. Mar. 7, 1957. 81p. Contract AT-11-1-GEN-14. $12.30(ph OTS); $4.50(mf OTS).

A finite difference method is developed for treating an integral form of the transport equation, wherein any type of particle, interaction, or geometry can in principle be included. The approximation involved is in the size of the intervals used for the discrete energy, angle, and space variables. Solutions are expressed in terms of the directional collision density as a function of lethargy and position. Problems are limited in magnitude by the capacity of the digital computers required for the calculation, and for this reason only cell problems have been considered, with scattering limited to six directions in space. Expressions are given for neutron and gamma-ray problems, including elastic and inelastic scattering, fission and radiative capture in the former case, and pair production, Compton scattering, and photoelectric absorption in the latter. Finally the method is applied to the example of an infinite, homogeneous reactor; and the energy spectra and values of the fast fission factor and resonance escape probability are given for a large range of water-to-uranium ratios. (auth)

2142 WAPD-AD(M)-20
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
OPTIMIZATION OF PWR-TYPE PRIMARY LOOPS. David H. Fax. Oct. 1954. Decl. May 8, 1957. 47p. Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30(mf OTS).

A method for deriving the optimizing equations for the primary loop parameters of PWR-type power plants is presented. One example of the application of the method to a given set of postulates is worked out in detail and the results of two sample calculations (based on two sets of assumed costs) are presented and compared. The flexibility of the method for accommodating postulates other than those used here is also discussed. (auth)

2143 WAPD-FE-417
[Westinghouse Electric Corp.] Atomic Power Div., Pittsburgh.
A GENERAL REVIEW OF CENTRIFUGAL CASTING AS A POSSIBLE METHOD FOR PWR FUEL ELEMENT MANU-

FACTURING. B. R. Price. Aug. 4, 1954. Decl. Apr. 15, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

Certain inherent characteristics of centrifugal casting make it desirable to consider using this process in the manufacture of Pressurized Water Reactor fuel elements. A general survey of the process and the factors which would determine its possible adoption in casting fuel materials for rod type fuel elements is reported. (L.T.W.)

2144 WAPD-FE-914

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

BURST TESTING OF SIMULATED WATER LOGGED FUEL BUNDLES. L. F. Cochrun. Aug. 22, 1955. Decl. Mar. 20, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

The effect of a water-logging accident on adjacent Zircaloy-2 clad sintered UO_2 rod bundles was studied. (T.R.H.)

2145 WAPD-FE-1057

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

DENSITY OF UO_2 FUEL COMPONENTS. A RESUME' OF PRESENT KNOWLEDGE AND RELATED EXPERIMENTAL PROGRAMS. B. R. Price. Oct. 31, 1955. Decl. Mar. 19, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

The relationship between fuel density and Shippingport Pressurized Water Reactor fuel element performance is discussed. The fabrication variables which determine the density of fuel components are given, and development programs regarding this relationship and these fabrication variables are outlined. (T.R.H.)

2146 WAPD-CP-1505

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

FEASIBILITY STUDY ON A SHIM ROD FACILITY LOOP. DYNAMIC IN-PILE LOOP CORROSION TESTING. A. P. Miller. Oct. 14, 1955. Decl. Mar. 4, 1957. 17p. $3.30 (ph OTS); $2.40(mf OTS).

A study was made to determine the feasibility of a MTR shim rod facility loop utilizing external loop equipment of the WAPD-13 dynamic corrosion loop. The necessary modifications are described in detail. Data are included on the decay of activated pressure tube and housing. (D.E.B.)

2147 WAPD-FE-958

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

AN INTERIM REPORT ON VIBRATORY PACKING FOR THE PERIOD OF OCTOBER 1954 TO APRIL 1955. H. R. Hoge. [Aug. 23, 1955.] Decl. Mar. 19, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

Experiments on vibratory methods for packing UO_2 fuel cores are described. (T.R.H.)

2148 WAPD-FE-1030

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

MANUFACTURE OF URANIUM–NIOBIUM FUEL RODS FOR IRRADIATION IN THE MATERIALS TESTING REACTOR. W. B. Haynes. Sept. 16, 1955. Decl. Mar. 19, 1957. 19p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Zircaloy-2 clad fuel rods whose fuel was U^{238} – 10 wt. % Nb-5 wt. % U^{235} were fabricated for testing in the Materials Testing Reactor. The fuel was duplex melted and given a homogenizing heat treatment prior to assembly into extrusion billets. The rods were prepared by co-extruding the fuel alloy in Zircaloy-2 cups, then drawing the rods to size. (auth)

2149 WAPD-IC-111

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

[ANALOG COMPUTER SOLUTIONS FOR THE XENON CONCENTRATION IN A REACTOR.] R. R. Leonard. Nov. 18, 1952. Decl. Apr. 15, 1957. 10p. $3.30 ph(OTS); $2.40(mf OTS).

2150 WAPD-MDM-14

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

TRITIUM HAZARD WITH LITHIUM BORATE IN PWR. William T. Lindsay, Jr. June 10, 1954. Decl. Mar. 21, 1957. 11p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Tritium activity of PWR coolant water brought about by the use of Li_3BO_3 control poisons presents no problem in the disposal of water bled from the primary system. If the average water replacement rate in a bleed-and-feed chemical control scheme is two system volumes per day, an air conditioning system employing a counter-current air scrubber, which is capable of maintaining the reactor compartment air at 100°F, will also be capable of maintaining the H_3 activity of the reactor compartment air at or below the tolerance level for breathing, providing the leak rates do not exceed 100 gallons per hour. No modifications would be necessary to enable the equipment to perform this additional function. There is no problem in disposing of used scrubbing water. (auth)

2151 WAPD-MDM-19

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ANALYSIS OF PWR FUEL ROD DEVELOPMENT PROCESSES. J. G. Goodwin, E. L. Richards, H. J. Snyder, and R. W. Thombaugh. Nov. 9, 1954. Decl. Mar. 19, 1957. 53p. Contract AT-11-1-GEN-14. $9.30(ph OTS); $3.60 (mf OTS).

An analysis is presented of the processes and methods which are considered to be the best so far developed for fabrication of Pressurized Water Reactor fuel rods. In brief, the process for producing the fuel rod will start with the as-cast raw materials which will be fabricated into co-extrusion billets by the most expedient process. The billets will be extruded to a relatively large diameter and then finished to a final diameter in the most efficient manner possible to provide the fuel rod stock. In many instances the assumptions and calculations used in making the numerous recommendations are given. The process and methods have been developed to produce a clad fuel rod having a final diameter of about 0.300 in. with a Zircaloy-2 cladding thickness of 0.030 in. The fuel alloy used is nominally 12 wt. % Mo in natural U. Cost and fabrication analysis for Zircaloy-2 billet components is presented. (L.T.W.)

2152 WAPD-MM-271

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CONFERENCE REPORT OF PWR FUEL ELEMENT DEVELOPMENT MEETING. T. J. Ilitis D. E. Thomas, and L. S. Castleman. Dec. 16, 1953. Decl. Feb. 1, 1957. 33p. $6.30(ph OTS); $3.00(mf OTS).

Data are tabulated on the parameters of a representative PWR plant, various types of fuel materials, corrosion behavior of fuel alloys, alloy transformations, dilatometry of fuel alloys, and on alloy phase studies. (T.R.H.)

2153 WAPD-MRC-40

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD JULY 1, 1953 TO AUGUST 15, 1953. Decl. Mar. 19, 1957. 18p. Contract AT-11-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

2154 WAPD-MRP-41(Del.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD AUGUST 15, 1953 TO NOVEMBER 1, 1953. Decl. with deletions Feb. 6, 1957. 35p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

Preliminary studies of PWR engineering and development are discussed. Some results of hot channel factors analysis are given. Melting and fabricating techniques for U–Zr and U–Mo alloys are discussed. Corrosion lives of U alloys are given. Tensile properties of Zr are reported. (B.J.H.)

2155 WAPD-MRP-54(Del.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD MAY 5, 1955 TO JUNE 16, 1955. Decl. with deletions Feb. 7, 1957. 110p. Contract AT-11-1-gen-14. $19.80(ph OTS); $6.30(mf OTS).

The current PWR plant and core parameters are listed. Design requirements are briefly summarized for a radiation monitoring system, a fuel handling water system, a coolant purification system, an electrical power distribution system, and component shielding. Results of studies on thermal bowing and stressing of UO_2 rods are reported. A graph is presented of reactor power vs. reactor flow for various hot channel conditions. Development of U–Mo and U–Nb alloys has been stopped because of the recent selection of UO_2 fuel material for the PWR core and blanket. The fabrication characteristics of UO_2 powders are being studied. Seamless Zircaloy-2 tubing has been tested to determine elastic limits, bursting pressures, and corrosion resistance. Fabrication techniques and tests for corrosion and defects in Zircaloy-clad U–Mo and UO_2 fuel rods are described. The preparation of UO_2 by various methods is being studied to determine which method produces a material most suitable for PWR fuel elements. The stability of UO_2 compacts in high temperature water and steam is being determined. Surface area and density measurements have been performed on samples of UO_2 powder prepared by various methods. Development work on U–Mo and U–Nb alloys has included studies of the effect on corrosion behavior of additions to the test water, additions to the alloys, homogenization of the alloys, annealing times, cladding, and fabrication techniques. Data are presented on relaxation in spring materials after exposure to a corrosive environment. Results are reported from loop and autoclave tests on fission product and crud deposition. Results of irradiation and corrosion testing of clad and unclad U–Mo and U–Nb alloys are described. The UO_2 irradiation program has included studies of dimensional changes, release of fission gases, and activity in the water surrounding the samples. A review of the methods of calculating reactor physics parameters has been completed, and the established procedures have been applied to determination of PWR reference design parameters. Critical experiments and primary loop shielding analyses are described. (D.E.B.)

2156 WAPD-PA-210

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR INSPECTION AND TEST PROGRAM. W. H. Hirst. Dec. 14, 1956. 42p. Contract AT-11-1-GEN-14. $7.80 (ph OTS); $3.30(mf OTS).

An inspection and test program is outlined which covers the pre-installation and post-critical performance of all PWR materials, equipment, and systems. (D.E.B.)

2157 WAPD-PC-48

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR CONTROL SYSTEM STUDY. G. L. Hartfield. Jan. 31, 1955. Decl. Apr. 15, 1957. 50p. Contract [AT-11-1-GEN-14]. $7.80(ph OTS); $3.30(mf OTS).

Three control systems were studied for the Pressurized Water Reactor plant. The study was performed at 10% power with the coolant flow at 50%. The plant was considered with temperature coefficients of -1.0×10^{-4} δk/°F and -2.5×10^{-4} δk/°F. It is shown that only one system provides adequate stability for the lower temperature coefficient if the steady state average coolant temperature is to be controlled within ±3° during fast Xe transients. (auth)

2158 WAPD-PWR-168

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

OPERATIONAL REQUIREMENTS FOR PWR. W. J. Purcell and N. E. Wilson. Aug. 13, 1954. Decl. Mar. 18, 1957. 25p. $4.80(ph OTS); $2.70(mf OTS).

The operating requirements for a central station electric power plant are examined. On the basis of this study it is recommended that the Pressurized Water Reactor be capable of accommodating power changes as follows: a change in power of 25% of its rating at a rate of 3% per second over the operating range of the plant, power increasing and decreasing; a loading and unloading rate of 3% per minute from 0 to 100% power and from 100 to 0% power. In order to permit PWR to be fully coordinated with the operation of the other generating units on the electric system, it is recommended that it be capable of maximum Xe override at the end of design life. (auth)

2159 WAPD-PWR-CP-2407

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

EVALUATION OF THE CAPABILITY OF THE DELAYED NEUTRON FUEL ELEMENT FAILURE DETECTION SYSTEM FOR PWR ON THE BASIS OF TESTS IN THE X-1 LOOP. P. W. Frank and K. H. Vogel. Aug. 24, 1956. Decl. Oct. 15, 1956. 35p. $6.30(ph OTS); $3.00(mf OTS).

2160 WAPD-PWR-FE-1165(Del.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

TENTATIVE SPECIFICATIONS FOR 1) ZIRCONIUM INGOT, 2) ZIRCONIUM STRIP, 3) URANIUM, 4) ZIRCONIUM-BASE FUEL ALLOY INGOT AND 5) ZIRCONIUM-BASE FUEL ALLOY STRIP FOR PWR SEED FUEL PLATES. PRELIMINARY PROCESS SPECIFICATIONS FOR PWR SEED FUEL PLATES AND FUEL ALLOY COMPONENTS. P. G. DeHuff. Feb. 8, 1956. Decl. with deletions Mar. 18, 1957. 24p. $3.30(ph OTS); $2.40(mf OTS).

The specifications were prepared to cover a fuel alloy utilizing iodide Zr crystal bar, an alloy utilizing 50% sponge Zr or Zircaloy-2 plus 50% iodide Zr crystal bar, and a fuel alloy utilizing sponge Zr or Zircaloy-2, in each case with addition of Sn, Fe, Cr, Ni, and U. (J.E.D.)

2161 WAPD-PWR-PCR-19

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

PWR SIMULATOR STUDIES. [Period covered: October 1955.] Decl. Mar. 18, 1957. 50p. Contract [AT-11-1-Gen-14]. $7.80(ph OTS); $3.30(mf OTS).

Simulator studies are presented on performance of the control system during large load reductions, controlled steam relief system simulation, performance of the control system when a pressure override signal is included, effects of rod "jumps," ability of plant to recover from spurious rod drops, and investigation of pressurizer surge line characteristics. (L.M.T.)

2162 WAPD-PWR-Ph-92

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ASYMMETRY IN PWR FLUX DISTRIBUTIONS DUE TO ASYMMETRIC POISON DISTRIBUTION. W. H. Hartley and R. F. Valentine. Apr. 1956. 11p. $1.80(ph OTS); $1.80(mf OTS).

An experiment was performed on the Pressurized Water Reactor mock-up facility to measure the asymmetry in the flux distribution caused by an unequal distribution of thermal neutron absorbing material (poison) in the seed region. This situation could occur in the actual PWR if there were an asymmetric buildup of Xe in the core. (L.T.W.)

2163 WAPD-PWR-Ph-112

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SLAB EXPERIMENTS. II. URANIUM METAL REFLECTOR. W. H. Hartley. May 1956. 59p. $9.30(ph OTS); $3.60(mf OTS).

Part III issued as WAPD-PWR-Ph-126.

A series of experiments on various configurations of a slab made of a highly enriched seed flanked by a natural U reflector has yielded information on core reactivity, flux distributions, and temperature coefficients. The reactivity was obtained experimentally by integration of rod worth and water worth curves. The curves were constructed from points taken with several configurations of blanket material. This procedure is shown to be valid if the flux is separable. Calculated values of core reactivity are high compared to experimental values derived by use of the standard inhour equation. Shutdown reactivity was determined semi-empirically by measurements of negative buckling in a region of the core occupied by control rods. (auth)

2164 WAPD-PWR-Ph-126

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SLAB EXPERIMENTS. III. URANIUM OXIDE REFLECTOR. W. H. Hartley. July 1956. 41p. $6.30(ph OTS); $3.00(mf OTS).

Part II issued as WAPD-PWR-Ph-112.

Experiments similar to those performed on an enriched slab seed with U metal reflector were made with a UO_2 reflector. Differential control rod worth and differential moderator worth curves were obtained and were compared with similar curves obtained from the metal reflected slab. From these curves, the excess reactivity of a slab was determined from a measurement of the slab critical height. Measurements of flux shapes in three directions were made in order to determine critical bucklings in the vertical and one horizontal direction and to investigate water channel flux peaking. (auth)

2165 WAPD-RDa-114

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REACTOR SAFETY DURING DECAY HEAT REMOVAL. Paul S. Sherba and Jerome Sherman. Oct. 5, 1955. Decl. Mar. 8, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

The performance of the PWR Decay Heat Removal System with respect to protection of the core, pressure vessel, and control rod mechanisms, was studied for four reactors. It was found that the convective flow rate of 1% full flow supplied by the decay heat removal system permits bulk boiling in the hot channel exit for a period that starts 10 to 15 sec after the loss of flow and continues for a period of 300 to 500 sec. However, the reactor power has dropped during this period to the point where the ratio of burnout flux to maximum reactor flux is at the safe value of 7.5 to 1. Therefore, the decay heat removal system satisfactorily protects the core. The pressure vessel and the control rod mechanisms are also protected, since the water exiting from the average channel never becomes saturated. (auth)

2166 WAPD-ReC(A)-50

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
A FEASIBILITY STUDY OF A HETEROGENEOUS CHEMICAL CONTROL SYSTEM FOR THE PWR. N. A. Petrick, W. A. Kerr, and A. P. D'Zmura. Feb. 19, 1954. Decl. Mar. 20, 1957. 51p. $9.30(ph OTS); $3.60(mf OTS).

One of the possible methods for control of the PWR is a system consisting of several tubes in the reactor core through which a high neutron cross-section liquid is circulated at adjustable concentrations to regulate the reactivity. The nuclear problems, the mechanical aspects of introducing the necessary piping into the pressure vessel and through the reactor core, and the external systems for circulating the poison and adjusting the poison concentration for such a system are considered. (auth)

2167 WAPD-RM-33

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PILE KINETICS FOR LINEAR RATE OF δ k INSERTION — THE WORST ACCIDENT SOLUTION. John C. Connor. [1951?]. Decl. Feb. 23, 1957. 9p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The pile kinetic equation for dn/dt is solved for a linear insertion of δk with respect to time rather than for the usual arbitrarily assigned step function δk. The rate of rise of n/no is much less rapid than for step function changes. An argument is presented that the most likely source of excess δk is the control rods themselves. It is possible to calculate n/no as a function of time for the maximum conceivable rate of rod withdrawal under accidental conditions. This has been done for the Naval Reactor and the resultant curve is the worst accident solution within the limits of validity of the assumptions made. (auth)

2168 WAPD-RM-38

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THEORETICAL CALCULATIONS ON ZPR EXPERIMENTATION. PART III. WORTH OF A SINGLE CENTRAL CYLINDRICAL CONTROL ROD. H. L. Garabedian. Jan. 26, 1951. Decl. Mar. 20, 1957. 37p. Contract AT-11-1-Gen-14. $6.30(ph OTS); $3.00(mf OTS).

A theoretical evaluation of the experimental result giving the worth of a single central cylindrical control rod made of Cd-Ag in terms of peripheral fuel is reported. The theoretical calculations were made with the use of three different types of boundary conditions designated as Canadian, Nordheim-Scalettar, and Diffusion. For the fully inserted cylindrical rod the three methods gave the critical masses. Since the Canadian method was believed on theoretical ground to be the best choice of the three methods studied, the relatively poor showing made by the Canadian method provoked further study. It was suggested that Ag possesses a strong resonance which is above the thermal range. This epi-Cd absorption was taken into account with the aid of a modified Canadian method, giving a theoretical result. Thus, the discrepancy between experiment and theory was essentially resolved. (auth)

2169 WAPD-RM-42

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THEORETICAL CALCULATIONS ON ZPR EXPERIMENTATION. PART IV. ANALYSIS OF NEUTRON AGE AND

THERMAL ABSORPTION CROSS SECTION FROM THE ZPR CLEAN CRITICAL EXPERIMENTS. J. J. Taylor. Mar. 1951. Decl. Feb. 25, 1957. 30p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

An investigation was made of those values of the two group neutron age (τ) and Zr thermal absorption cross sections (σ_{Zr}) which uniquely satisfy the data for a pair of critical assemblies obtained by the ZPR project at ANL. The pair of values which result are $\tau = 64$ cm^2 for a Zr to H_2O volume ratio of 1:1 and $\sigma_{Zr} = 0.24$ b. This assumes that the fast fission effect and resonance capture is not negligible and that $\epsilon p = 1.01$. The accuracy to be expected is no better than ±20% for σ_{Zr} and ±10% for τ which is too large to permit any direct determination of the proper ZPR or STR two-group constants. The calculations in addition indicate that the fast fission effect is sufficiently important to be included in subsequent core design calculations. (auth)

2170 WAPD-STR-L-494

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR (EASE) SIMULATOR STUDY—SERIES II. J. P. Franz and N. F. Simcic. June 28, 1955. Decl. Mar. 7, 1957. 173p. $27.30(ph OTS); $8.10(mf OTS).

The differential equations, plant parameters, and design considerations used in simulating the PWR primary plant are presented, as well as the results of the studies made on this preliminary plant design. Since this is based on a preliminary design the simulation represents an approximate description of the plant behavior, and the results are presented for use in proceeding with the design of the actual PWR plant. As the PWR plant design progressed, the simulation was modified to incorporate these latest changes. (auth)

2171 WAPD-TH-290

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] PRESSURE DROP THROUGH SFR BOTTOM PLATE OFIFICE MODEL. B. W. LeTourneau and R. D. Oldenkamp. Jan. 12, 1957. 10p. $1.80(ph OTS); $1.80 (mf OTS).

An orifice through the SFR (Submarine Fleet Reactor) bottom plate is used to control the leakage flow used to cool the nonfueled parts of the core. Because of the non-standard orifice sizes and shapes used, it was necessary to determine experimentally the pressure drop through the bottom plate orifice. (L.T.W.)

2172 WASH-23(Del. 2)

Reactor Safeguard Committee, AEC.

ELEVENTH MEETING OF THE REACTOR SAFEGUARD COMMITTEE AT NORTH AMERICAN AVIATION, INC., DOWNEY, CALIFORNIA, ON JUNE 29 AND 30, 1950. Aug. 21, 1950. Decl. with deletions Feb. 6, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

The reactor Safeguard Committee presents its comments, criticisms, and recommendations on the provisions taken to ensure the safety of various reactors (MTR, HRT, PPA, CP-3, LPRR, CP-5) against accident or sabotage. The present evaluations of meteorological, hydrological, and geological situations with respect to safety of neighboring populations against reactor catastrophe are particularly criticized. (W.L.H.)

2173 WIAP-NM-16

Westinghouse Electric Corp. Industrial Atomic Power Group, Pittsburgh.

DETERMINATION OF REACTIVITY LIFETIME FOR LOW ENRICHMENT, LIGHT WATER MODERATED POWER REACTORS. H. W. Graves, Jr. Oct. 15, 1954. Decl. Mar. 4, 1957. 77p. $0.55(OTS).

This report describes the effect that variation in enrichment and water-to-metal ratio have on the reactivity lifetime of low enrichment water moderated thermal reactors. Since both reactivity lifetime and enrichment have a significant effect upon reactor fuel costs, the variation in these costs is also discussed. The present high chemical processing and fabrication costs cause the most economical operating condition to be one in which the fuel elements are fissioned to a limit determined by radiation damage considerations. The enrichment and water-to-metal ratio should therefore be selected to obtain maximum lifetime with minimum enrichment subject to the conditions imposed by temperature coefficient considerations. Only when these fuel processing costs are much lower relative to the cost of fissionable material will conversion ratio and fuel inventory interest rate become significant in determining fuel costs. The calculation of k_{eff} as a function of time for low-enrichment reactors must account for the effect of resonances in the Pu isotopes. A method is described herein by which the resonance absorption in Pu^{239} and Pu^{240} may be taken into consideration in determining reactivity lifetime. Calculations which include these absorption effects yield values of reactivity lifetime which are considerably lower than those which have been calculated previously. (auth)

2174 TID-10117

Babcock and Wilcox Co. Atomic Energy Div., Akron, Ohio.

REACTOR STUDIES—FINAL REPORT. Part I. Nov. 1955. Decl. Mar. 13, 1957. 169p. $1.10(OTS).

Thorium Converter Power Reactor Study. A study was made on a reactor to operate at a 500 mw power level. The fuel assemblies consist of U bearing and Th bearing flat plates clad with zircalloy. Reactor core, reflector, and control system designs are also discussed. Preliminary critical mass calculations were made using modified two-group theory and cylindrical geometry. The results of calculations of group constants, neutron flux distributions, excess reactivity, Xe and Sm transients, temperature coefficient of reactivity, neutron lifetime, and burnout and isotope buildup are given. Results of the study indicate the feasibility of such a reactor. Analysis of Flashing Cycles for Pressurized Water Package Power Reactors. The possibilities of steam power production by flashing of hot, high pressure reactor coolant water are considered. Control and hazards are discussed and a schematic diagram of the cycle is given. Heterogeneous Boiling Reactor. A design study was made for a package boiling reactor and an associated steam plant designed to produce 2.2 mw of electricity. The fuel plates are highly enriched UO_2 in a stainless steel matrix and are stainless steel clad. The core is cooled by vaporization and moderated with circulating light water. Saturated steam is extracted by cyclone separators and used to drive a turbo-generator. Burnout poison in the form of a B^{10} compound is incorporated in order to reduce the reactivity variation with core life. The designs were made on the basis of minimum of development effort, reliability, and maximum safety. Research Reactors. The development of a water boiler type research reactor is discussed. The designs were based on economy, safety, and usefulness in educational institutions. Representative plans are shown. Critical mass and core optimization calculations are given. Other features discussed include the water cooling system, the reactor He gas system experimental facilities, and control systems. Uranyl sulfate solution is used as the fuel, and graphite is used as the reflector and shield. Designs for a water column reactor, which is a modified version of the ORNL Low Intensity Training Reactor, are also discussed.

Shielding Studies. The emitted γ spectrum and self shielding properties of a given core design are derived, and a method of plotting fast and slow neutron and γ fluxes through bulk shielding materials is discussed. Examples are shown. Burnout Heat Flux Studies. Available data on light H_2O burnout data in the region of net steam generation are evaluated. Results show that burnout heat flux increases with increased entrance subcooling, burnout heat flux increases with increased mass flow rate, and burnout heat flux decreases with increased pressure at the higher mass flow rates but reaches a maximum at about 1200 psia for lower flow rates. (B.J.H.)

2175 Y-F10-80(Del.)
Oak Ridge National Lab., Y-12 Area, Tenn.
CIRCULATING FUEL REACTORS. C. B. Mills. Jan. 8, 1952. Decl. with deletions Feb. 21, 1957. 32p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

A set of bare reactor calculations is presented which indicates the static characteristics and critical masses of BeO moderated and H_2O moderated reactors. The effects on reactivity and design of circulating the enriched U fuel through the reactor and heat exchanger in an alkali fluoride carrier are evaluated. (L.T.W.)

2176 Y-829
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
EMPIRICAL STUDIES OF CRITICAL MASS DATA. PART II C. L. Schuske and J. W. Morfitt. Dec. 5, 1951. Decl. Mar. 16, 1957. 26p. Contract W-7405-eng-26. $4.80 (ph OTS); $2.70(mf OTS).

In a previous report a method of graph analysis was developed for obtaining the critical dimensions of semi-infinite U^{235} water reactors from measurements made on finite systems. The empirical treatment is applied here to analysis of experimental data. The cases considered are: (1) a comparison of critical conditions occurring in Al-walled and stainless steel-walled reactors, and (2) a comparison of critical conditions in isolated and interacting pairs of water-reflected cylinders at the moderation which minimizes the critical volume. (auth)

Particle Accelerators

2177 CRD-T1-58
California Research and Development Co., Livermore, Calif.
CURRENT INTENSITY PROFILES IN CIRCULAR SWEEPING. R. L. McKisson and N. R. LeRoy. Mar. 24, 1952. Decl. Feb. 14, 1957. 4p. (LWS-24300). $1.80(ph OTS); $1.80(mf OTS).

2178 CRD-T1-100
California Research and Development Co. Livermore, Calif.
THERMAL CYCLING OF BISMUTH. C. D. Newnan. Apr. 24, 1952. Decl. Feb. 14, 1957. 47p. (LWS-24326). $9.30 (ph OTS); $3.60(mf OTS).

Thin bismuth wafers bonded to aluminum on both faces were internally pulse heated while being continuously water cooled through the Al bonded faces. Electrical pulses for resistance heating were delivered to the sample by a low voltage, high current transformer and auxiliary pulsing equipment. Continuous cooling and pulse heating result in thermal cycling of the Bi at repetition rates of 40 cycles/sec. The Bi wafer with its two aluminum bonded faces simulates two sections of the Mark I target sandwich placed face to face, for the thermal gradient rises from a cold bond to a hot center and then falls to a cold bond in the mirror image. A summary of experimental results is tabulated. Under conditions of the test a maximum thermal cycle of 55°F was sustained in the Bi until terminated by equipment failure. Over 100 million cycles were accumulated at 37°F thermal cycle without failure. Metallurgical examination of this latter sample showed that no changes occurred. (auth)

2179 UCRL-1884
California. Univ., Berkeley. Radiation Lab.
THE CLOVERLEAF CYCLOTRON THREE PHASE RADIO-FREQUENCY SYSTEM. Bob H. Smith. Sept. 9, 1952. Decl. Mar. 5, 1957. 39p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

Detailed descriptions and schematic diagrams are given of the various components of the three-phase r-f system of the 20-in. cyclotron. Once adjustment is achieved the machine behaves as if there were three separate single-phase systems. (J.E.D.)

Radiation Absorption and Scattering

2180 KAPL-783
Knolls Atomic Power Lab., Schenectady, N. Y.
GAMMA-RAY ABSORPTION DISTRIBUTIONS FOR PLANE, SPHERICAL, AND CYLINDRICAL GEOMETRICS. M. L. Storm, H. Hurwitz, Jr., and G. M. Roe. July 24, 1952. Decl. Mar. 27, 1957. 60p. Contract W-31-109-Eng-52. $0.40(OTS).

The spatial distribution of γ-ray absorption is computed for surface and volume γ-ray sources with various geometries. Several simple angular distributions are considered for the surface sources. Exponential attenuation is assumed, together with the straight-ahead approximation. The results are presented in both analytic and graphic form, with normalizations for application to reactor heat-generation problems (auth)

Radiation Effects

2181 CF-56-1-20
Oak Ridge National Lab., Tenn.
METALLOGRAPHIC ANALYSIS OF KAPL SAMPLE 3R, 6R, 18R, AND 19R. M. J. Feldman, A. E. Richt, and E. J. Manthos. Jan. 4, 1956. Decl. Mar. 13, 1957. 46p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Results of the metallographic examination of the fuel rods indicated that the breaks in four samples were at points of minimum clad and no corrosion penetration of the stainless steel clad was seen. All cracks in the clad were apparently due to core expansion. Differences in the UO_2 matrix structure were noted in a comparison of the control and irradiated samples. Differences in the post-irradiated hardness of comparable samples in the two capsules were recorded. (J.E.D.)

2182 NAA-SR-75(Del.)
North American Aviation, Inc., Downey, Calif.
THE EFFECT OF CYCLOTRON IRRADIATION ON THE PHYSICAL PROPERTIES OF METALS. A. B. Martin, M. Tarpinian, and R. R. Eggleston. Jan. 8, 1951. Decl. with deletions Feb. 27, 1957. 43p. Contract AT-11-1-GEN-8. $6.30(ph OTS); $3.00(mf OTS).

Metals and alloys were irradiated at about −150°C with a 33 Mev α beam. Electric resistivity, hardness, dimensions, and lattice parameters were measured on Al, Cu, Zr, Al−U alloys, Zr−U alloys, AuCu and $AuCu_3$ superlattice alloys, and a Be−Cu precipitation hardening alloy before and after irradiation. (T.R.H.)

2183 ORNL-138(Del.)
Oak Ridge National Lab., Tenn.
INTERIM REPORT ON EFFECTS OF REACTOR RADIATIONS ON METALS. Joint Report of Metallurgy and Physics Divisions. D. S. Billington. Oct. 27, 1948. Decl. with deletions Mar. 6, 1957. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Reactor radiation effects on the physical properties of stainless steel, monel metal, nickel, steel, Be–Cu alloys, and various other alloys are summarized. Metallographic techniques for examining microstructures of irradiated samples are discussed. (B.J.H.)

2184 TID-5186(Del.)
California Research Corp., Richmond, Calif.
RADIATION RESISTANT LUBRICANTS—THEIR DEVELOPMENT AND STATUS. Progress Report for May 1, 1951 through June 30, 1954. R. O. Bolt, J. G. Carroll, and J. R. Wright. June 30, 1954. Decl. with deletions Feb. 26, 1957. 66p. Contract AT(11-1)-74. $0.45(OTS).

Information from gamma radiation stability experiments and lubrication functional tests are given. In applications where viscosity change is not critical, conventional mineral oil and synthetic base lubricating fluids may be used, in the substantial absence of air, for incident gamma radiation dosages up to about 10^9 r. In cases where only small viscosity changes are permissible, the limiting dosage is about half this value. The presence of air also generally lowers this limiting dosage by a factor of two. Such limiting exposures also vary with the identity of the base fluid in approximately the following order of increasing stability: silicones, esters, mineral oils, ethers, and alkylaromatics. Additional aryl groups tend to increase stability; the presence of aliphatic polymers tends to reduce stability. Chemical additives also have various effects; materials containing S and Se are beneficial while those with N and P tend to decrease the radiation limits of usefulness. Less stable base oils can be made to withstand up to about 5×10^9 r with these beneficial additives. Oils of maximum stability can be made from alkylaromatic base fluids, polystyrene-type thickeners, and selected additives. These products, for use at incident dosages up to about 10^{10} r, exhibit no unusual problems of wear or of oxidation stability. Greases are extremely sensitive to the action of radiation. The gel structure is affected and a tendency toward softening is exhibited. With conventional metallic soap-mineral oil products, this effect becomes excessive at about 5×10^8 r. Special formulations of a radiation-resistant alkylaromatic base and selected thickeners show less consistency change at this dosage. At ten times this value the softening becomes excessive even with these materials. (auth)

2185 TID-10070
Knolls Atomic Power Lab., Schenectady, N. Y.
A REVIEW OF THE METALLIC FUEL ELEMENT DEVELOPMENT PROGRAM. Herbert R. Anderson, Jr. Mar. 1, 1953. Decl. Feb. 25, 1957. 15p. Contract W-31-109-Eng-52. $0.25(OTS).

A review of the work that demonstrated the feasibility of certain metallic fuel elements when irradiated to a high average burnup is presented. Alloy additions of Zr and Cr to U increase markedly the ability of U to resist irradiation growth. Type 347 stainless steel jackets successfully contained and retained fuel and fission products with no apparent dimensional changes during irradiation. (auth)

2186 WAPD-RM-205(Del.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EFFECTS OF NEUTRON BOMBARDMENT UPON THE PROPERTIES OF ASTM TYPE SA212-B STEEL. M. L. Bleiberg. Feb. 1, 1954. Decl. with deletions Mar. 7, 1957. 26p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70 (mf OTS).

Changes in properties of ASTM Type SA212B steel were determined after an irradiation at process water temperatures in the MTR. The electrical resistivity of the irradiated specimens increased for exposures at relatively low flux but was unchanged after higher flux exposures. It is believed that the gamma heating in the higher flux was sufficient to prevent the occurrence of radiation induced electrical resistivity changes. Hardness increases were observed which appeared to have reached a saturation value. The notch toughness of the irradiated specimens was greatly decreased and the brittle impact transition temperature was increased. The magnitude of these impact property changes appeared to be flux (or integrated flux) dependent. Annealing heat treatments restored the hardness as well as the impact energy values to their unirradiated values. (auth)

Shielding

2187 CF-50-5-29
[Oak Ridge National Lab., Tenn.]
FISSION PRODUCT ACTIVITY OF X SLUGS. J. A. Lane. May 2, 1950. Decl. Feb. 15, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Fission product activity measurements of MTR slugs were made for design data for discharge chute shielding and channel water depth. (T.R.H.)

2188 NAA-SR-Memo-1143
North American Aviation, Inc., [Downey, Calif.].
MEASUREMENT OF NEUTRON ATTENUATION IN SHIELD MATERIALS. W. W. Brown and B. A. Engholm. Nov. 4, 1954. Decl. Mar. 14, 1957. 39p. $0.40(OTS).

Measurement of the attenuation, by iron, magnetite concrete, ordinary concrete, and aluminum, of the neutrons emerging from the top of the water boiler reactor thermal column is described. Attenuation of the thermal and epithermal neutrons was measured with indium foils, and that of neutrons above 1 ev, 0.5 Mev, and 1.5 Mev with a BF_3 proportional counter in paraffin moderator and Np^{237} and U^{238} fission counters respectively. (auth)

Spectroscopy

2189 Y-435
Carbide and Carbon Chemical Corp. Y-12 Plant, Oak Ridge, Tenn.
SAMPLE EXCITATION FOR SPECIAL INVESTIGATIONS. Sam Adams, D. D. Smith, and L. E. Burkhart. May 12, 1949. Decl. Mar. 6, 1957. 17p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Several special types of excitation are described. Moving plate studies indicate the relative effectiveness of four types of carriers in the analysis of U_3O_8 for Cu, Fe, Mo, Mg, and Sn. The use of high and low pressure atmospheres in the classification of spectra and the elimination of CN bands is discussed. Some information on the source conditions for the mass analysis of uranium samples is presented. Preliminary work on the use of U in a hollow cathode source and on the detection of low concentrations of uranium is also described. (auth)

Uranium and Uranium Compounds

2190 CF-55-5-140(Rev.)
Oak Ridge National Lab., Tenn.
RATIO OF U-232 TO U-233 PRODUCED IN THE TBR.

Lawrence Dresner. May 23, 1955. Decl. Mar. 8, 1957. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The production of U^{232} in the cost optimized TBR and one-region thorium oxide-uranium oxide slurry reactor has been estimated to be, respectively, 40 and 260 parts per million parts of U^{233} produced. These production rates are compared with corresponding production rates in irradiated thorium rods and found to be comparable. Recommendations are made for increasing the purity of the U^{233} product. (auth)

2191 HKF-1492D-39

Ferguson (H. K.) Co., New York.

CRITICALITY HAZARDS IN PROCESSING 1% ENRICHED URANIUM. Kenneth C. Cooper. Sept. 24, 1951. Decl. Mar. 14, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

Possible hazards involved in the Mallinckrodt procedures for processing 1%-enriched U are analyzed, and necessary precautions are specified. No danger is possible in handling any amount of nominally 1% U in the reduction of UF_4 to metal, cooling, or remelting. Critical amounts might conceivably be accumulated during the rolling to $\frac{3}{4}$" rod, in which case an "always safe" amount is indicated. (B.J.H.)

2192 LA-1477

Los Alamos Scientific Lab., N. Mex.

NEUTRON BURST FROM A CYLINDRICAL UNTAMPED OY [ENRICHED U] ASSEMBLY. E. C. Mallary, G. E. Hansen, G. A. Linenberger, and D. P. Wood. July 22, 1952. Decl. Mar. 26, 1957. 23p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

A neutron burst from an untamped cylindrical enriched U assembly occurred at the Pajarito Remote Control Laboratory at 1800 hours on 18 April, 1952. The circumstances causing the burst and a description of the assembly involved are given. There was no personnel hazard. Normal operations could have been resumed on other assemblies within two or three hours after the burst. No evidence of damage to the enriched U was observed. Also reported are some results of computations and post-burst tests and a discussion of probable time behavior of power level during the burst. (auth)

2193 TID-5139

Dow Chemical Co. Rocky Flats Plant, Denver.

EMPIRICAL EQUATIONS OF CRITICAL INFINITE CYLINDERS CONTAINING AQUEOUS SOLUTIONS OF UO_2F_2. C. L. Schuske. June 16, 1953. Decl. Mar. 14, 1957. 16p. Contract AT(29-1)-1106. (CD-53-00603). $3.30(ph OTS); $2.40(mf OTS)

The stainless-steel-walled critical reactor data previously reported (using 93.4% U^{235} assay) are extrapolated graphically for $H:U^{235}$ atomic ratios of from 20 to zero. The atomic ratio of zero represents a reactor core containing only high-density UO_2F_2 salt. All cores are completely H_2O-reflected. Values of the infinite slabs and infinite cylinders are then derived. These infinite-cylinder values along with values at the other moderations are represented by a single empirical equation. An empirical equation of the same form is derived for the Al-walled reactors. The critical masses for the equilateral cylindrical vessels for the high-U^{235} concentrations are calculated, making use of the infinite-cylinder and slab values reported above. (auth)

PERSONAL AUTHOR INDEX

This is an index for the reports abstracted in this issue. For each reference the number preceding the dash is the volume number and the number after the dash is the abstract number. Personal author indexes are cumulated on a semiannual and annual basis.

A

ACKLEY F E
12-2110
ADAMS PAUL H
12-2017
ADAMS SAM
12-2189
ADDINGTON N G
12-2033
ADLER K L
12-1854
AKIN R J
12-2067
ALEXANDERSON E L
12-2067
ALLEN P W
12-2041
ALLISON ESTHER
12-2042
ANDERSON HERBERT R JR
12-2185
APKARIAN HARRY
12-1926
ARNOLD H R
12-1828

B

BABCOCK A R JR
12-1895
BADGLEY F I
12-2041
BAER WILLIAM
12-2040
BAIRD J N
12-1954
BALENT RALPH
12-2129 12-2131
BANKS C V
12-1833
BARAD M L
12-2041
BARNES J W
12-1860
BARRODY E M
12-1971
BARTHELEMY C R
12-2192
BAUMAN R
12-1862
BAYARD ROBERT T
12-2040
BEAUMONT A J
12-1886
BEAVER R J
12-1978
BEDFORD A W JR
12-1943
BELL G I
12-2043
BELLE J
12-1920 12-1921
12-2008 12-2009
BENGSTON JOEL
12-2065
BENNION D R
12-2061
BERGSTRESSER KARL S
12-1843
BETHE H A
12-2043 12-2081
BIEHL A T
12-2129
BILLINGTON D S
12-2183
BLANCO R E
12-1869 12-1870
12-1871 12-1872
BLASEWITZ A G
12-1878
BLEIBERG M L
12-2186
BLOSSER H G
12-2068
BOCHINSKI J
12-1883
BOLT R O
12-2184
BOSTROM W A
12-2013
BRAMMER H A
12-2122
BREWER LEO
12-1990
BRIDGER G L
12-1881 12-1882
BRIDGES W H
12-1995
BRIGGS A R JR
12-2085
BRITTAN R O
12-2055
BROMLEY LEROY A
12-1990
BROOKSBANK W A JR
12-1845
BROWN PAUL F
12-1857
BROWN W W
12-2188
BROWNE S H
12-2124
BRUCH C A
12-1985 12-1986
BRUCKNER R F
12-1935
BUFFUM R S
12-1873
BULKOWSKI H H
12-1863
BURDICK F F
12-2078
BURGER LELAND L
12-1879 12-1880
BURKART M W
12-1966
BURKHART L F
12-2189

C

CARRON M W
12-1940
CARLSON JULIA
12-2042
CARLSON O N
12-1981
CARLSON R J
12-1972
CARNEY K G JR
12-2090
CARROLL J G
12-2184
CARSON H G
12-2133
CASHIN W M
12-1985 12-1986
CASTLEMAN L S
12-2152
CERUTTI R
12-2055
CHARPIE R A
12-1900
CHIOTTI P
12-1981
CHRISNEY J R
12-2129
CLAIBORNE S J
12-1850
CLARK R F
12-1873
CLEWETT G H
12-1878 12-1906
12-2035
COCHRUN L F
12-1948 12-1949
12-2005 12-2144
COHEN E R
12-2127 12-2129
COHEN S I
12-1851 12-1852
CONN A L
12-2032
CONNOR JOHN C
12-2167
COOPER KENNETH C
12-2191
COOPER L
12-1850
COWAN R F
12-1922
CRANDALL H W
12-1909
CRISLER T L
12-2030
CROWSON D L
12-2041

D

DAVIDSON D F
12-2084
DAVIS J P
12-2067
DAVIS W D
12-1984
DAYTON RUSSELL W
12-1825 12-1974
DEBOISBLANC D R
12-2077
DEEM H W
12-1971
DEHUFF R G
12-2160
DELAPLAINE JOHN W
12-1863 12-1875
DEWEES N R
12-2024
DICKERSON R F
12-1972
DIKE R S
12-2021
DODGE F
12-1897
DOLL D T
12-1913 12-2030
DONAVEN T W
12-2056
DONOVAN J J
12-1827 12-1858
DOWIS W J
12-2074
DOYLE R L
12-1877
DREESZEN W F
12-1892
DRESNER LAWRENCE
12-2190
DROEGKAMP R F
12-2002
DRURY J S
12-2035
DUCKWORTH WINSTON H
12-1951 12-1979
DUFFEY D K
12-1873
DUKE F R
12-1893
DUNCAN J D
12-2030
DUNCKLEE R F
12-2110
DURHAM FRANKLIN P
12-2120
DWIGHT AUSTIN F
12-1969
DZMURA A P
12-2166

E

EASTMAN E D
12-1900
ECKBERG K
12-1891
EDDY N S
12-1977
EGAN C J
12-1953
EGGLESTON R R
12-2182
EHRLICH P
12-2082
EIFERT D R
12-2087
EISENBUD M
12-2041
EISTER W K
12-1867
ELDREDGE D J
12-2020
ELSON R E
12-1889
EMMONS A H
12-1845
ENGHOLM R A
12-2188
EPP A A
12-1855
EPSTEIN G H
12-2104
ESSELMAN W H
12-1929
EVANS J F
12-2051

F

FANELLI F A
12-2066
FASSEL V A
12-1893
FAST F
12-2078
FAX DAVID H
12-2142
FELDMAN M H
12-2125
FELDMAN M J
12-2181
FERGUSON D F
12-1866 12-1869
12-1870 12-1871
12-1872
FIRTH GEORGE
12-1916
FISHER CHARLES F
12-1838
FISHER D S
12-2030
FISHER R W
12-1882
FITZGIBBONS J D
12-2067
FLAHERTY J W
12-1967
FLUHARTY R G
12-2039
FOREST F P
12-2088
FORSYTHE W L JR
12-2032
FOSTER F S
12-2010
FOWLER R D
12-1829
FOX G E
12-1979
FOX J K
12-2070
FRANK P W
12-2159
FRANKS A F
12-1993
FRANZ J P
12-2170
FRIEDMAN H A
12-1849
FROST R T
12-2093
FRYE GLENN M JR
12-2047
FULMER F T
12-1833 12-1850
FURNAS T C
12-1860 12-1907

G

GAIDOS E
12-1927
GALLAGHER J G
12-2068
GALONIAN G E
12-1957
GALVANEK P JR
12-1905
GAMMEL JUANITA H
12-2047
GARABEDIAN H L
12-2168
GARWIN R
12-2027
GELBARD ELY
12-2038
GIFFEN R H
12-1882
GILBREATH J R
12-1823
GILLES PAUL W
12-1900
GILLEY L W
12-2070
GINSBURGH A S
12-2066
GOAD W B JR
12-2043
GOELLER H E
12-1917 12-2031
GOETZ C A
12-1839
GOLDBERG M D
12-2069
GOLDMAN K M
12-1963
GOODWIN J G
12-2151
GOODWIN W W
12-2109
GOSLINE C A
12-2041
GOST J W
12-1845
GOTTSCHALL H A
12-1826
GOVE H E
12-2053
GRAVES H W JR
12-2173
GREENFIELD M A
12-2126
GRESKY A T
12-1868

GRIFFEL M
12-1833
GRIMAUD A V
12-2075
GUSTAFSON C H JR
12-1952

H

HAAG F G
12-1935
HAGEN L A
12-2091
HALAPATZ J
12-2006
HALPERIN J
12-1900
HALTEMAN E K
12-2009 12-2019
HAMILTON W H
12-1929
HANNER J L
12-1839
HANSEN G E
12-2192
HANSEN R S
12-1833
HANSON G H
12-2075
HARTFIELD C L
12-2157
HARTLEY W H
12-2162 12-2163
12-2164
HARVEY J A
12-2049
HAYNES W R
12-2001 12-2148
HAYWARD R R
12-1912
HENRY ALLAN F
12-2044
HICKMOTT R L
12-2061
HILL V K
12-2137 12-2138
HIRST W H
12-2156
HOCKETT J F
12-2030
HOFFMAN C G
12-1913
HOFFMAN H W
12-1930
HOFMANN P L
12-2092
HOGE H R
12-2147
HOLBY G V
12-1863
HOLLAND J Z
12-2041
HOLLEY C E JR
12-1829
HONOHAN HARRY J
12-1938
HOUGHTON W J
12-2174
HOUSE H P
12-1842
HOUSTON R W
12-2041
HOWARD D
12-2129
HUFFMAN J P
12-2076
HUGHES D J
12-2049
HUGHES H F
12-2038
HUMPHREY P A
12-2041
HUNT T W
12-1932 12-1936
HURFORD W J
12-2010
HURWITZ H JR
12-2180
HYMAN H H
12-1874

ILTIS T J
12-2152
INHOFF D H
12-2072
ISSEROW S
12-1902

J

JACKET H S
12-1936 12-1939
JACKSON H K
12-1898
JARVIS G A
12-2121
JENKS G H
12-1934
JOHNSON A E JR
12-2079
JOHNSON E R
12-1877
JOHNSON H A
12-1932
JOHNSON W E
12-1908
JONES D T
12-1954
JONES L J
12-1921 12-2009
JONES T I
12-1913
JONES T N
12-1851 12-1852
JURNEY E T
12-2110

K

KASS STANLEY
12-1958
KASTEN P R
12-2060 12-2064
KAUZLARICH J J
12-2084
KEARNS JOHN J
12-2014
KEFLER J R
12-1976 12-1977
KELCHNER R L
12-1888 12-1910
KEMMER F R
12-1979
KERR W A
12-2166
KING BURNHAM W
12-1973
KIRKBRIDE L D
12-2011
KLACH STANLEY J
12-2118
KLEPANOW H L
12-1971
KLOTZBACH R J
12-1866 12-1900
KOENIG GLORIA K
12-2118
KOENIG W W
12-1955
KOHMAN T P
12-2029
KOLB J O
12-2067
KONOPINSKI EMIL J
12-2028
KROHN N A
12-2061
KUNZ F W
12-2119

L

LAGANI A JR
12-2095
LANDRUM L H
12-2133
LANE J A
12-2187
LAPOINTE J R
12-1950
LAWSON E N
12-2062
LEADERS W M
12-1896
LEE D A
12-2035
LEFEVRE H W
12-2050
LEIBZIGER E D
12-1956
LEMONS J F
12-1829
LEONARD B R
12-2149
LEPPKE D M
12-2132
LEROY N P
12-2177
LESCISIN J J
12-1947
LEYOURNEAU R W
12-2171
LEUZE R F
12-1899
LEWIS W B
12-1829
LICHTENBERGER H V
12-2055
LILLIE DAVID W
12-2016
LINDSAY WILLIAM T JR
12-2150
LINENBERGER G A
12-2192
LOCKHART R W
12-2094
LOFGREN NORMAN L
12-1990
LOFTNESS R L
12-1841 12-2125
LOMBARDO J J
12-2012
LONG R E
12-1951
LOSCO E F
12-2008 12-2009
LOVERDE ANTHONY
12-1834
LUFKE F A
12-2082
LUSTMAN B
12-1964 12-1966

M

MACCREADY W K
12-2074
MACHTA L
12-2041
MAGLERY E H
12-2051
MAGOTEAUX O R
12-1876
MALLARY E C
12-1911 12-2192
MALONEY J O
12-2033
MALOTTE W H
12-1877
MANN J E
12-2068
MANNESCHMIDT J F
12-1876
MANTHOS F J
12-2181
MARAMAN W J
12-1886
MARRON J V
12-1947
MARSHALL J M
12-2086
MARSHALL R P
12-1908
MARTIN A R
12-2182
MARTIN D S JR
12-1833
MATHAY PHILIP W
12-1857
MATTHEWS P R
12-1907
MAUTZ F W
12-1876
MCADOO JOHN D
12-2118
MCCARTHY W J
12-2061
MCCLELLAN L W
12-2039
MCCOWN W E
12-1928
MCCURDY H C
12-2047
MCDUFFIE H E
12-2137 12-2138
MCKEEGHAN CHARLES D
12-2089
MCKISSON R L
12-2177
MCWHERTER J R
12-1900
MILKO J A
12-1904
MILLER A J
12-1826
MILLER A P
12-2146
MILLER JAMES L
12-1890
MILLS C R
12-2175
MILLS W M
12-2129
MONTOYA E M
12-1913
MOORE M S
12-2051
MOORE R A
12-2061
MORRECK R C
12-1901
MORFITT JOHN W
12-1817 12-2176
MOSES H
12-2041
MUNGER H P
12-2041
MUSGRAVE T P
12-1979
MYERS R F
12-2041

N

NAGLER K M
12-2041
NANCE R L
12-1886
NATALE NICOLO R
12-1863 12-1875
NELSON E
12-1900
NELSON H R
12-1975
NERESON NORRIS
12-2042
NEUER J J
12-2121
NEWELL J F
12-2041
NEWNAN C D
12-2178
NEWTON H
12-2041
NICHOLSON E H
12-2053
NICHOLSON E L
12-1900
NIGON J P
12-1907
NOBLE J L
12-1991
NOLTE D F
12-2114
NORWOOD PEARL
12-2042

O

OCONNOR J J
12-2066
ODOM C H
12-1900
OLCOTT R N
12-2121
OLDENKAMP R D
12-2171
OLLIFF W
12-2054
OLSON R E
12-1854
OPIE J V
12-1860
ORNDOFF J D
12-2021
OSBORNE D W
12-1822 12-1824
OTT H C
12-2140
OWENS J T
12-2080

P

PAINE R W JR
12-2021
PAITCHEL H
12-2116
PELLAND M S
12-1905
PENNEMAN R A
12-1907
PETRETZKY P R
12-2095
PETRICK N A
12-2066 12-2166
PIGOTT J M
12-2080
PILCHER V E
12-2049
PLANT WILLIAM R
12-1946
PRICE B R
12-2143 12-2149
PURCELL W J
12-2158

Q

QUINN G F
12-1873

R

RABB D D
12-1918
RASEMAN C
12-1862
RASOR N S
12-1855
REDFORD J L
12-1954
REICHARD HAROLD F
12-1989 12-2118
REID D G
12-1865
REID G C
12-1860
REITER W M
12-1863
RELM T M
12-1879
REYNOLDS S A
12-1845
RICE R
12-2055
RICHARDS E L
12-2007 12-2151
RICHARDSON A C
12-1918
RICHT A E
12-2181
RIGSTAD N J
12-1865
RIPLEY C C
12-1941
ROARTY J D
12-1936 12-1939
ROBERTSON K L
12-2074
ROBINSON J F JR
12-1942
ROBINSON L B
12-2130
ROBINSON R C
12-1928
RODDEN C J
12-1868 12-1904
ROE R J
12-1863
ROE G M
12-2180
ROOF R B JR
12-2012
ROSEN LOUIS
12-2047
ROSENBLUTH A
12-2027
ROSENBLUTH M
12-2027
ROYBAL J C
12-1886
RUBIN B
12-1889
RUEHLE A E
12-1896 12-1897
RUNDLE R E
12-1833
RUNION T C
12-1876
RUTENKROGER F O
12-1877

S

SALLER H A
12-1970 12-1971
12-1972 12-1976
12-1977
SANBORN K L
12-1955
SANDOCK J
12-2079

PERSONAL AUTHOR INDEX

SATTIZAHN J E
12-2121
SAVASTIO L A
12-2098 12-2099
SCHANER R F
12-2004
SCHEIB LOUIS
12-2136
SCHEIBLE H G
12-1989
SCHELL R S
12-2105
SCHENEL R J
12-2069
SCHIEF DANIEL
12-2141
SCHIEF R R
12-2097
SCHMITT J M
12-1826
SCHOENFELD H Z
12-1951
SCHULTE JOHN W
12-1887
SCHULTZ JOHN
12-1973
SCHUSKE C L
12-2176 12-2193
SCOTT R R
12-2112
SCOVILLE V R
12-2109 12-2115
SECOY C H
12-2134
SENIO PETER
12-2025
SHAPIRO Z M
12-1919
SHAW K G
12-1883
SHERRA PAUL S
12-2165
SHERMAN JEROME
12-2165
SHIMIZU H
12-1827
SHULL H
12-1893
SHYNE J J
12-1989
SIMCIC M F
12-2170
SIMCOF C R
12-1965 12-2000
SIMON V H
12-2132
SIMPSON O C
12-1829
SIMPSON O D
12-2039
SLANSKY C M
12-1879
SMITH ROB H
12-2179
SMITH D D
12-2189
SMITH J R
12-2051
SMITH JACK H
12-2089
SMITH M F
12-2041
SMITH W C JR
12-2007
SNYDER M J
12-2151
SORENSON C W
12-2096
SPEDDING F H
12-1833
SPIEGEL JAMES I
12-1937
SPIEWAK I
12-2079
SQUIRES DOROTHY
12-2042
STACK T G
12-2092
STACY J T
12-1970 12-1971
STARITZKY EUGENE
12-1829
STARR F
12-2092
STATHOPOLIS A
12-2066
STEEL G
12-2129
STEINER F C
12-2102 12-2111
STEPHENS R M JR
12-1918
STERN THEODORE
12-2132
STEWART C R
12-2121
STIRLING R G JR
12-2079
STOKES R H
12-1945
STONE H E
12-2098
STORM M L
12-2180
STOUGHTON R W
12-1900
STROM G H
12-2041
STUART J G
12-2056
STUMPF H J
12-2061
SULLIVAN W H
12-2029
SUMSION H T
12-1983
SUSANO C D
12-1842
SVEC H J
12-1839
SWIFT OLIVER F
12-2040

T

TARPINIAN M
12-2182
TAUB J M
12-1919 12-2030
TAYLOR J J
12-2169
TEER R R
12-1947
TEPE J R
12-1873
TERRELL OSCAR D
12-2087
THALGOTT F W
12-2035
THOMAS D E
12-1962 12-1965
12-2000 12-2011
12-2152
THOMAS HENRY C
12-1890
THOMAS J R
12-1909
THOMPSON W F
12-2135
TILSON F V
12-2095
TIPTON CLYDE R JR
12-1825 12-1974
TOMBAUGH R W
12-2009 12-2007
12-2151
TONCUFCIK ANDREW S
12-1890
TOOPS F C
12-2052
TRIPLETT J R
12-2050
TRIPP HARLAN P
12-1973
TROCKI T
12-1992
TUCKER CHARLES W JR
12-2025
TUCKER W D
12-1882
TWICHELL L P
12-2035

V

VAIL D R
12-1942 12-1943
12-1944
VALENTINE R F
12-2162
VAN SCHAACK R K
12-2110
VANDENBERG L R
12-2091
VANZANDT T F
12-2026
VARTANIAN H
12-1989
VOGEL K H
12-2159
VOIGT A F
12-1833

W

WAGNER F L
12-1826
WALDMAN L A
12-2041
WALDROP F R
12-2035
WALLACE J L
12-2066
WALSH A P
12-2106
WALSH K A
12-1885
WALTER F J
12-1924
WANTA R C
12-2041
WATSON CLYDE D
12-1864
WEIL J W
12-2089
WEINBERG A M
12-2059
WEISMAN J
12-1862
WEISNER F
12-2129
WERLE J E
12-2066
WESTMORELAND J C
12-2101
WHATLEY M F
12-1881 12-1883
WHEELOCK N R
12-1947
WHITAKER G C
12-1909
WHITTEMORE D J JR
12-1952
WIGNER F P
12-1900
WILHELM H A
12-1882
WILLIAMS D V P
12-2049
WILLIAMS P D
12-2035
WILSON N F
12-2158
WINCHESTER P S
12-1886
WINTERS C F
12-2134
WISCHOW P P
12-1868
WISE W W
12-1947
WOLCOTT J P
12-2074
WOLF J F
12-2032
WOOD D P
12-2021 12-2192
WOODARD R W
12-2035
WOODWARD F C
12-2066
WORSHAM C H
12-1901
WRIGHT F S
12-1965
WRIGHT J R
12-2184
WROUGHTON DONALD M
12-1959 12-1961
12-1960
WYATT JAMES L
12-1839 12-1902
12-1996 12-1997
WYMAN L L
12-1988

Y

YOUNG D S
12-2121

Z

ZEITLIN H R
12-1900
ZERBE J F
12-1936 12-1939
ZMOLA P C
12-2062 12-2063

NUMERICAL INDEX OF REPORTS

This is a list of reports abstracted in this issue of *Nuclear Science Abstracts*, with the corresponding abstract number reference.

The report number codes listed below apply to AEC reports unless otherwise designated. Other codes are listed as British, Canadian, or Non-AEC. Those codes marked Misc. are used for both AEC and non-AEC reports. For a complete description of all report number codes used by the AEC, see TID-85, *Report Number Series Used by the Technical Information Service in Cataloging Reports*. September 1957. 112p. $3.00 (OTS). Some reports appear under more than one code designation and wherever practical all report numbers are listed in this index.

Report No.	Abstract No.
A (Misc.)	
7.390.29	12-1817
1051	12-1860
2361	12-2032
3936(Del.)	12-1908
4003	12-1909
AECD	
3733	12-1953
4242	12-2052
AECU	
3352	12-2017
3395	12-2026
AEP	
37(Pt. 1)	12-2053
ANL	
4000(Del.)	12-1818
4003(Del.)	12-1967
4006(Del.)	12-1819
4185(Del.)	12-1820
4286(Del.)	12-1821
4490(Del.)	12-1822
4613(Del.)	12-1823
4680	12-2018
4943(Rev.)	12-1824
5153(Del.)	12-1968
5209	12-1969
ANL-DHL	
51	12-2054
ANL-FWT	
105	12-2055
APEX (Misc.)	
142(Rev.)	12-2056
BKC	
2828(Del.)	12-1861
BMI (Misc.)	
701(Del.)	12-1970
863(Rev.)	12-1971
956	12-1972
1034	12-1973
1057(Del.)	12-1825
1076(Del.)	12-1974
BMI-HRN	
8(Del.)	12-1975
BMI-T	
6	12-1976
13	12-1951
16	12-1977
BNL	
250(Del.)	12-2049
285	12-2057
345	12-1862
C (Misc.)	
2.350.6	12-1826
CCCO	
422	12-1863
CD	
53-00803	12-2193
CEPS	
1121(Del.)	12-2058
CF (Argonne National Lab.)	
3211	12-2029
CF (ORNL)	
47-10-89	12-1864
47-10-230	12-1865
49-11-328(Del.)	12-1866
50-5-29	12-2187
51-10-194(Del.)	12-2059
52-6-78	12-2060
52-8-163	12-1850
52-8-227(Del. 2)	12-2061
52-10-79	12-2062
52-11-164	12-2063
53-3-206	12-2064
53-7-190	12-2065
53-8-106	12-1930
53-8-226(Del.)	12-2066
54-3-196	12-1954
55-5-59	12-1851
55-5-140(Rev.)	12-2190
55-8-194(Del.)	12-2067
55-9-150	12-1867
55-11-66	12-2068
55-11-97	12-1868
55-11-165	12-2069
56-1-20	12-2181
56-3-16	12-1924
56-5-33(Del.)	12-1852
56-7-36	12-1858
56-7-148	12-2070
56-8-26	12-1978
56-8-109	12-1869
56-9-95(Del.)	12-1870
56-10-7(Del.)	12-1871
56-10-48	12-1827
56-10-128(Del.)	12-1872
CN	
2492	12-1873
3685	12-1874
COO	
19	12-2033
92	12-2071
CRD-T	
1-58	12-2177
1-100	12-2178
4A-24	12-2072
D (Misc.)	
F-14	12-1889
DPST	
54-569	12-1998
DPWR	
148	12-1838
ESP	
52-47	12-1828
FMPC	
1	12-1875
150(Del.)	12-1876
532	12-1877
GEAP	
2(Del.)	12-2073
H	
5.320.9	12-1878
HKF	
4	12-1979
1492D-39	12-2191
HKF-AED	
100	12-2034
HW	
14764(Del.)	12-1940
18595	12-1955
19949	12-1879
27851	12-2050
32405(Del.)	12-1854
33531(Del.)	12-2074
33682	12-1880
3-1341	12-1980
3-3048	12-2029
HZ	
11	12-1838
18	12-1839
25	12-1902
30	12-1997
100	12-1996
IDO	
16146	12-2075
16209(Del.)	12-2076
16348	12-2077
16352	12-2078
16355	12-2039
16366	12-2051
ISC	
35	12-1859
115	12-1881
134(Del.)	12-1882
137	12-1832
170	12-1883
184	12-1833
389(Del.)	12-1981
453	12-1982
K	
318	12-2079
KAPL	
247(Del.)	12-2019
251	12-2080
294	12-2081
749(Del.)	12-2025
783	12-2180
908(Del.)	12-2082
960(Del.)	12-1983
1100(Del.)	12-1984
1155(Vol. 2)	12-2045
1173(Del.)	12-2083
1564(Del.)	12-1985
1604(Del.)	12-1986
KAPL-M	
DED-3	12-2084
EDL-5	12-1941
KAPL-M	
EDL-8	12-1987
EDL-13	12-1942
EDL-22	12-2085
EDL-23	12-1943
EDL-24	12-1944
EDL-40	12-2020
EDL-49	12-1945
EDL-82	12-2086
EDL-107(Pt. 1)	12-2087
EPF-1	12-2088
FDL-1	12-1956
FGH-2	12-1925
GEG-6	12-1957
JHS-2	12-2089
JLN-2	12-1931
KGC-2	12-2090
LBV-8	12-2091
LLW-1	12-1988
PLH-3	12-2092
RCD-22	12-1946
RTF-3	12-2093
RWL-2(Rev.)	12-2094
SMS-16	12-2095
SMS-18	12-2096
SMS-28	12-2097
SMS-30(Rev. 1)	12-2098
SMS-33	12-2099
SMS-35 and Add-1	12-2100
SMS-40	12-2101
SMS-48	12-2102
SSD-2(Rev. 2)	12-2103
SSD-3(Rev. 3)	12-2104
SSD-8(Rev. 2)	12-2105
SSD-14(Rev. 1)	12-2106
SSD-20(Rev. 1)	12-2107
SSD-21	12-2108
SSD-23(Rev. 2)	12-2109
SSD-24(Rev. 1)	12-2110
SSD-26(Rev. 2)	12-2111
SSD-35(Rev. 1)	12-2112
SSD-38	12-2113
SSD-39(Rev. 1)	12-2114
SSD-41(Rev. 1)	12-2115
SSD-44	12-2116
KLX	
1604	12-2117
1617	12-1884
10006	12-2118
10021(Del.)	12-1989
LA	
1079(Del.)	12-1907
1089	12-1910
1234	12-2042
1289	12-2021
1305	12-1911
1397	12-1912
1445	12-2043
1477	12-2192
1648	12-2119

NUMERICAL INDEX OF REPORTS

Report No.	Abstract No.
LA	
1659	12-1829
1715	12-1913
1724	12-2120
1741	12-2028
1850	12-2027
1861	12-1885
1991	12-1886
2023	12-2121
2025	12-1843
2034	12-2030
2037	12-1887
LAMS	
1245	12-1888
LMFR	
9	12-1862
LRL	
68(Del.)	12-2122
LWS	
22679(Del.)	12-1889
24300	12-2177
24326	12-2178
M (Misc.)	
333(Pt. 2)	12-1914
333(Pt. 3)	12-1915
2147	12-1916
2761	12-1890
4409	12-1990
4518	12-1952
MB-LB	
12B-6	12-1990
MCW	
230	12-1891
MIT	
1114	12-1991
MLM	
554(Del.)	12-1892
716(Rev.(Del. 2))	12-1893
828(Del. 2)	12-1830
929(Del. 1)	12-1831
MUC-GTS	
357	12-1894
N (Misc.)	
422	12-1894
NAA-SR	
31(Del.)	12-2123
75(Del.)	12-2182
91	12-2124
94(Del.)	12-2125
129(Del.)	12-2126
155	12-2127
NAA-SR-Memo	
107(Del.)	12-2128
278	12-2129
542	12-2130
721	12-2131
1143	12-2188
NAA-SR-MTA	
24(Del.)	12-1855
NBS-D (Misc.)	
124	12-2022
NEA	
5301(Del.)	12-2132
NMI	
1160	12-1992
NPG	
112	12-2133
NYO	
112(Del.)	12-1895
1186	12-1993
1234	12-1834
1239	12-1835
1352	12-1896
5146	12-1897
ORNL	
138(Del.)	12-2183
159	12-2046
611	12-1917
612	12-2031
788(Del.)	12-1844
816	12-1845
925	12-2134
955(Del.)	12-1846
962(Del.)	12-1898
980	12-1899
1036(Del.)	12-1836
1129(Del.)	12-1847
1153(Del.)	12-1837
1424(Del.)	12-2135
1638(Del.)	12-1900
1732(Rev.)	12-2023
1774	12-1994
1875(Del.)	12-1995
1915(Del.)	12-2136
2004(Del.)	12-2137
2057(Del.)	12-2138
2148	12-2139
PTR	
50	12-2077
69	12-2078
89	12-2039
142	12-2051
R (Misc.)	
49GL82	12-1932
50GL231	12-1926
SE-PC	
68	12-2029
SOD	
19	12-1901
SRO	
13	12-1996
14	12-1838
15	12-1839
16	12-1997
21	12-1902
TID	
278(Del.)	12-1933
5100	12-1918
5139	12-2193
5186(Del.)	12-2184
5193	12-1840
5424	12-1998
7003(Del.)	12-1848
7007(Pt. 2(Del.))	12-1856
7507(Del.)	12-1999
7513(Pt. 2)	12-1853
10002	12-1903
10041	12-1841
10070	12-2185
10073	12-2047
10081	12-2041
10092	12-2140
10117	12-2174
10143	12-1904
UCLA	
260	12-1816
UCRL	
1884	12-2179
WAPD	
51(Rev.)	12-2000
108	12-2141
123	12-2001
WAPD-A1W	
(M)-71	12-1958
WAPD-A1W	
(RD)-526	12-1947
WAPD-AD	
(M)-20	12-2142
WAPD-AD	
(T)-1095	12-1934
WAPD-ARS	
(A)-2	12-1935
WAPD-C	
129	12-1959
137	12-1960
141	12-1961
WAPD-CP	
1505	12-2146
WAPD-CTA	
(RM)-312	12-2024
WAPD-FE	
417	12-2143
452	12-2002
456	12-2003
493	12-2004
893	12-1948
914	12-2144
958	12-2147
1004	12-1949
1005	12-2005
1030	12-2148
1057	12-2145
WAPD-IC	
111	12-2149
WAPD-LSR	
(IM)-1	12-1936
WAPD-MDM	
7	12-2006
14	12-2150
19	12-2151
24	12-1962
WAPD-MM	
200(Del.)	12-1963
271	12-2152
WAPD-MRC	
40	12-2153
WAPD-MRP	
41(Del.)	12-2154
54(Del.)	12-2155
WAPD-NCE	
524	12-2007
WAPD-P	
91	12-2044
WAPD-PA	
210	12-2156
WAPD-PC	
48	12-2157
WAPD-PM	
37	12-1927
WAPD-PMM	
167	12-1919
WAPD-PWR	
168	12-2158
CP-2407	12-2159
FE-1165(Del.)	12-2160
PCR-19	12-2161
Ph-92	12-2162
Ph-112	12-2163
Ph-126	12-2164
PMM-429(Del.)	12-1920
PMM-466(Del.)	12-1921
PMM-496(Del.)	12-1922
PMM-601	12-2008
PMM-625	12-2009
WAPD-RDa	
114	12-2165
WAPD-ReC	
(A)-50	12-2166
WAPD-RM	
17	12-1964
33	12-2167
38	12-2168
40	12-1965
42	12-2169
86	12-2040
96(Del.)	12-2010
174	12-1857
205(Del.)	12-2186
WAPD-STR	
L-494	12-2170
WAPD-T	
39	12-1928
40	12-1929
175	12-2037
215	12-1937
308	12-2011
310	12-1938
319	12-1939
387	12-1923
403	12-1966
407	12-2012
415	12-2013
417	12-2014
419	12-1950
WAPD-TH	
290	12-2171
WAPD-TM	
17	12-2015
18	12-2038
WASH	
23(Del. 2)	12-2172
120(Del.)	12-2016
WIAP-NM	
16	12-2173
WIN	
31	12-1905
Y	
118(Del.)	12-1906
185(Del.)	12-2035
435	12-2189
495	12-2048
548	12-2036
829	12-2176
1059	12-1849
Y-B	
31-273(Del.)	12-1842
Y-F	
10-80(Del.)	12-2175

act No.

2158
2159
-2160
-2161
-2162
-2163
-2164
-1920
-1921
-1922
-2008
-2009

-2165

-2166

-1964
-2167
-2168
-1965
-2169
-2040
-2010
-1857
-2186

-2170

-1928
-1929
-2037
-1937
-2011
-1938
-1939
-1923
-1966
-2012
-2013
-2014
-1950

-2171

-2015
-2038

-2172
-2016

-2173

-1905

-1906
-2035
-2189
-2048
-2036
-2176
-1849

-1842

-2175

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Athens, Greek Atomic Energy Commission
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Guatemala, Comision Nacional de Energia Nuclear
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Bombay, Department of Atomic Energy
IRAQ
Baghdad, The Ministry of Development, Atomic Energy Division
ISRAEL
Tel Aviv, Israel Atomic Energy Commission
ITALY
Rome, Comitato Nazionale Ricerche Nucleari
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